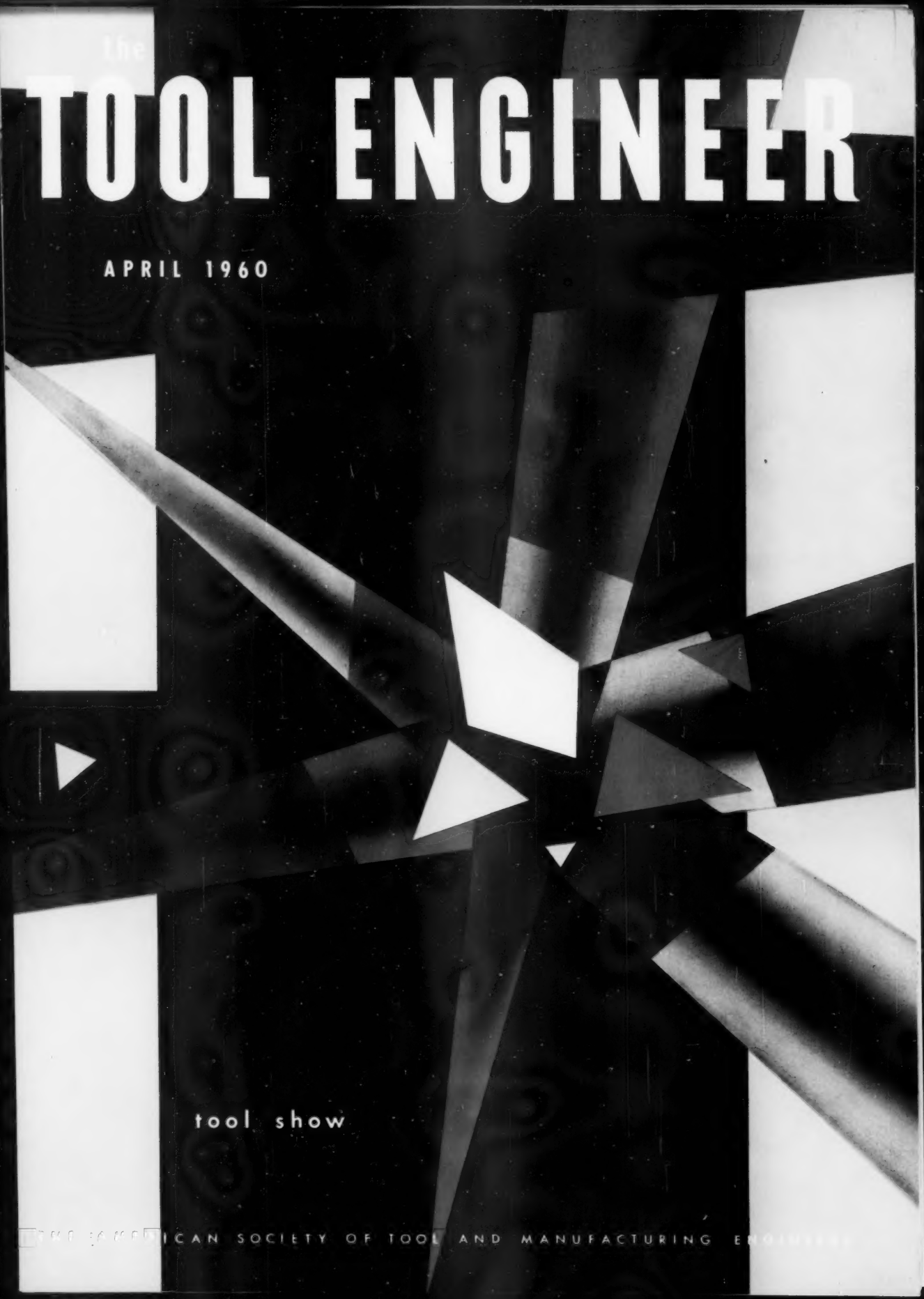
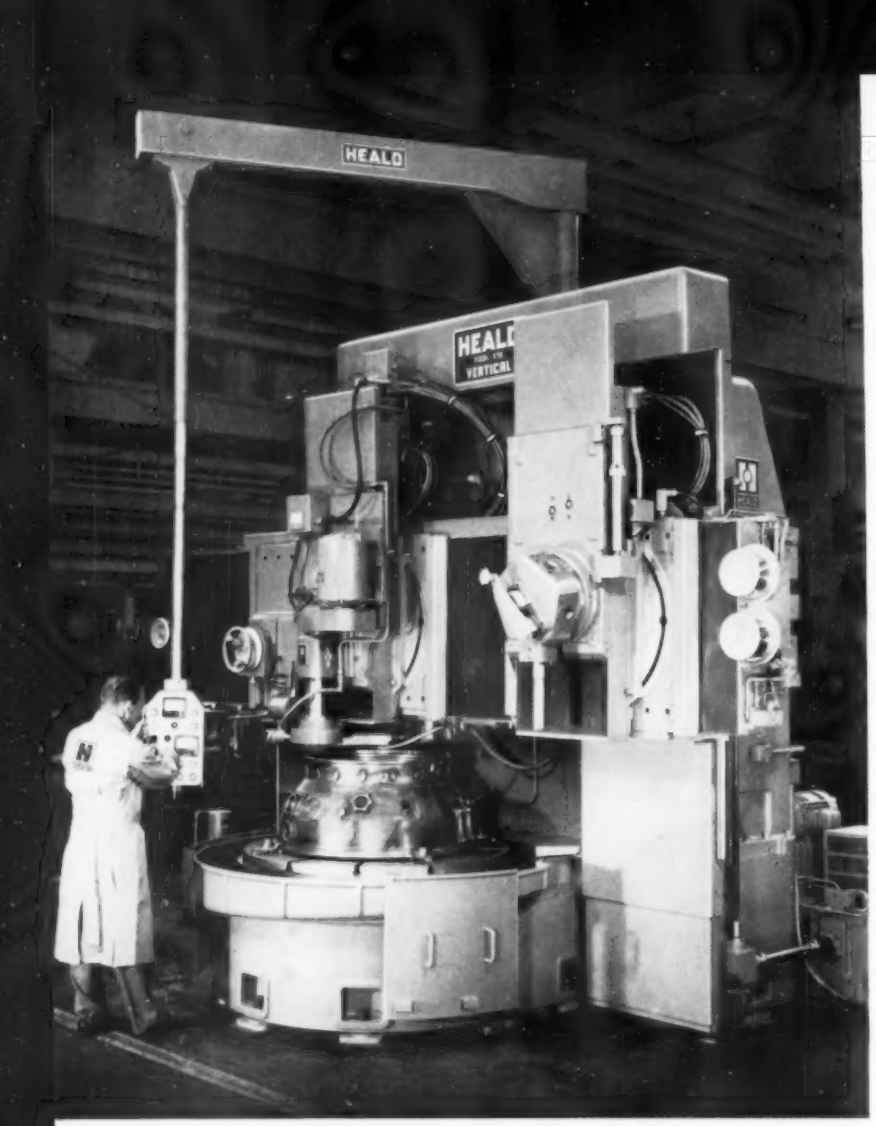
The TOOL ENGINEER

APRIL 1960



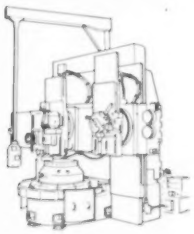
tool show

THE AMERICAN SOCIETY OF TOOL AND MANUFACTURING ENGINEERS

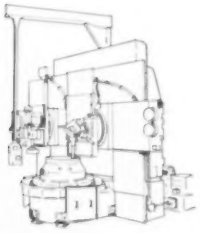


new

from HEALD



IT PRECISION GRINDS
I.D.s, O.D.s, Tapers and Faces



IT BORES, turns, faces
grooves and chamfers

MODEL 578 VERTICAL GRINDING MACHINE

speeds rebuilding of jet engines at United Air Lines

REFINISHING big jet engine parts calls for high precision internal and external grinding, as well as a variety of rough and finish boring, turning and facing operations. United Air Lines is meeting both of these requirements to excellent advantage with the completely new Heald Model 578 Vertical Grinding Machine shown above.

With two separate and independently controlled vertical slides — one for grinding and the other for Borizing — this massive unit is really two machines in one. Either vertical slide can be positioned over the work by indexing on a common cross rail. Both vertical slides have 20 inches of travel and can be swiveled 45° to either side of the vertical position for doing angular surfaces. The grinding head can be used for I.D., O.D. or rotary surface grinding and the turret-type Borizing head accommodates up to five boring bars. The work table will take parts up to 48″ high and 52″ in diameter and can be operated at speeds from 2½ to 180 rpm.

All operating controls are centralized on a pendant control box which can be raised or lowered 24″ and swung to any area around the machine for operation from any position.

If your operations call for combined grinding and Borizing of large work, be sure to look into this radically new Heald machine. Your Heald engineer will be glad to give you complete information.

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MMT-PE
MODERN MACHINE TOOLS
PRODUCTION EFFICIENCY

the tool engineer

Vol. 44, No. 4
April 1960

Creative Manufacturing IS TOOL ENGINEERING

MODERN PRODUCTION LINES

Control: Key to Efficient Mass Production ..... *By T. W. Black* 73
Production of compact cars illustrates how controls at all stages of manufacture and assembly lead to low costs, high quality.

Control: Key to Efficient Small-Lot Production ..... *By Robert Heslen* 82
Versatile automatic machining lines make it possible to produce diesel engine components in small lots with long-run efficiency.

ADVANCED MANUFACTURING METHODS

Recent Developments in Ultrahigh-Speed Machining ..... *By R. L. Vaughn and R. T. Krueck* 95
Tests in which cutting tools or workpieces travel at rifle-bullet velocity show it is feasible to machine at over 100,000 fpm.

Drilling High-Strength Materials 101
When drilling Space-Age materials, tool life can be improved remarkably by slight changes in drill design and cutting conditions.

Plasma Flame Speeds Metalworking ..... *By James A. Browning* 105
Used for metalcutting and metallizing, the plasma flame may become useful for turning and drilling hard-to-machine materials.

Why Form Explosively? ..... *By A. Frank Watts and Dorsie C. Harleman* 109
Forming at 300 to 800 feet per second, using energy from high explosives, is practical and economical from a production standpoint.

Cold Swaging Extends Design Horizons ..... *By P. A. G. Carbonaro and S. Valencia* 113
Swaging lends itself to the production of internal contours such as gun barrel rifling, giving fine finishes.

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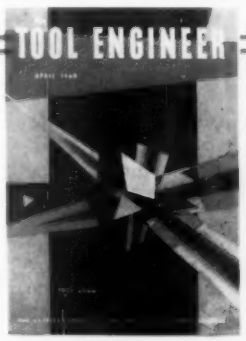
THIS MONTH'S COVER

The time: April 21-28. The place: Detroit, site of ASTME's 28th Annual Engineering Conference and Exhibit, where thousands of engineers and executives will bring themselves up to date on advances in manufacturing theory and practice. In a departure from THE TOOL ENGINEER's usual covers, artist William Solms has chosen to show some basic mathematical forms, symbolizing the mathematical and scientific foundations of modern manufacturing.



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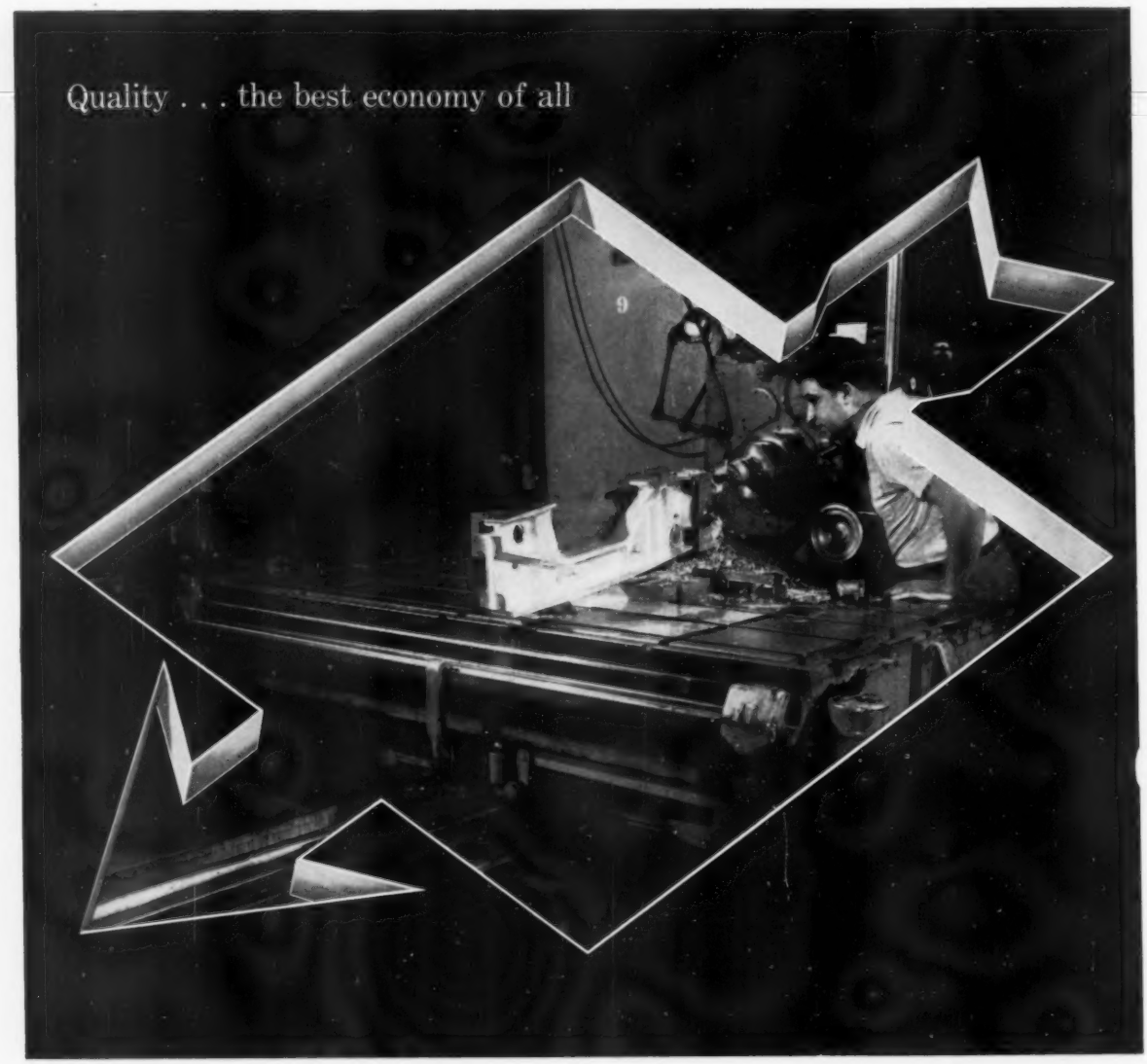

Fight the cost of "Stick-Slip" with Sunoco Way lubricant

"Stick-slip", the alternate grabbing and releasing of slow-moving carriages, can seriously score machine ways and ruin fine workpiece finishes.

Avoid this trouble and expense with Sunoco Way Lubricant, known throughout the world for its ability to cure "stick-slip". Special ingredients in Sunoco Way Lubricant form a durable, reinforced lubricating film along the mating surfaces. Result: There is no metal-to-metal contact even during week-end shutdowns; machines start easily; carriages move without intermittent grabbing. YOU GET FINER FINISHES, FEWER REJECTS.

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Opportunities Unlimited

The challenge of limitless opportunities to use a better material or to develop a better method of manufacture than now being used beckons to all. We need, however, to have courage and imagination, applying already known data to manufacturing methods to build a better product.

This wide-open door to achievement was discussed by H. Dale Long, ASTME vice president, in an inspirational talk to students at the recent chartering of the Society's student chapter at Western Ontario Institute of Technology, Windsor, Ontario. All of the possibilities and opportunities available to these students are also available to us. Certainly, a young student who has elected manufacturing for his career must be anxious to contribute his bit and must be looking forward to the day when he will have the opportunity through practical problems.

In this relatively new profession, so new that many are not yet aware of its professional stature, firm groundwork has been laid upon which to build. This groundwork is accumulated information and data. The intelligent application of these data to new production problems is tool engineering in its broad meaning.

Available to the tool and manufacturing engineers are new miracle materials and new plastics that are stronger, tougher and more stable than previously. Also, new processes and methods bid fair toward making many conventional processes obsolete.

With opportunities unlimited, a better product can be built. A better product does not mean a cheaper product. It means instead more durable, more reliable, more precise, more versatile—in fact, more useful.

A better product means a better market. A better market means more favorable world trade. Favorable world trade means more opportunity to build other products better. In this "space age" where reliability is the watchword, there is no room for less than the best. The opportunities to achieve this are indeed unlimited.

John W Greve

EDITOR

NEW...from DAVIS

Throwaway insert cutters
for "Super-Mike" tooling!
.0001" precision adjustment accuracy
No backlash — cutter is adjusted without releasing setscrew pressure on shank.

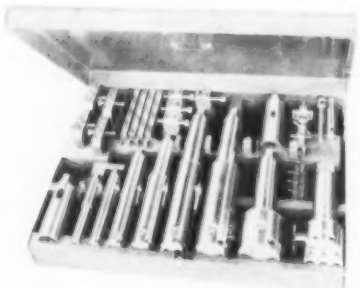
Completely interchangeable in any "Super-Mike" unit.

...bringing you a combination of advantages never before available in boring tools

Now you can have the economies of throwaway carbide inserts together with the versatility and precision of Davis "Super-Mike" micrometer-adjustable flycutter tooling. Here are just a few of the advantages:

- Absolutely accurate adjustment to .0001" because there is no backlash in the "Super-Mike" assembly — see above.
- Greater range of adjustment than in any similar flycutter tooling assembly.
- More tool support than in any similar assembly.
- A complete range of cutters with cutting angles to suit the work.
- Complete interchangeability with other "Super-Mike" cutters.

This is the most completely versatile and most economical to use micrometer-adjustable flycutter tooling available today. Call your Davis distributor or write for details and prices on throw-away insert cutters for your Davis "Super-Mike" tooling (if you are not now using "Super-Mike" flycutters, be sure to ask for Catalog No. D-520).



"Super-Mike" assemblies available in stub boring tool sets, stub and line bars, multiple-cutter boring heads, extension boring heads, and many other types of standard and special Davis tooling.

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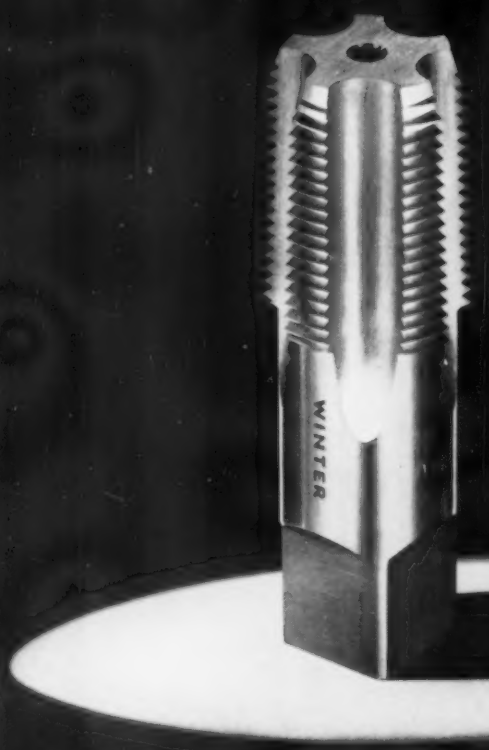

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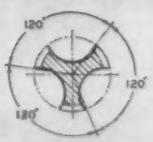
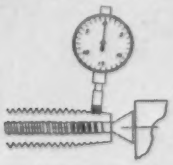


EXACT FLUTE SPACING



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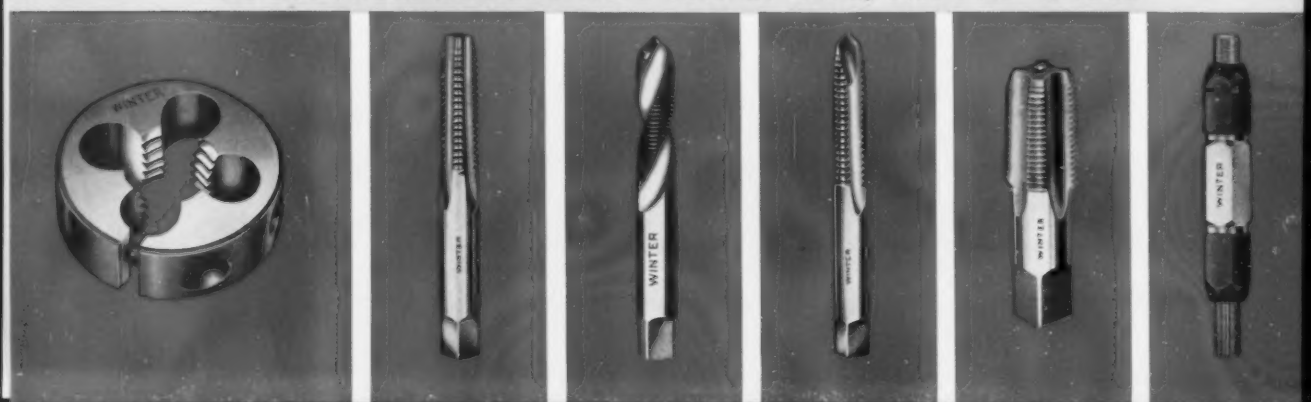

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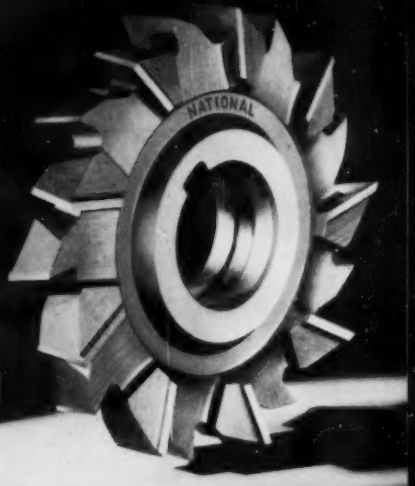

side milling cutters and metal slitting saws *

tools plus...

Staggered Tooth Side Milling Cutters put National's popular "plus" benefits in your deep slotting operations by giving you longer tool life with less chatter . . . even at higher speeds and heavier feeds!

National's **Metal Slitting Saws with side chip clearance** are specially designed for deep, narrow slotting, as well as sinking in cuts. Adequate chip space is provided, thus preventing binding and scoring of the work piece.

You can expect reduced metal cutting costs when you specify National . . . the tools "plus". Call your local National Distributor today; he's tops in service, too.

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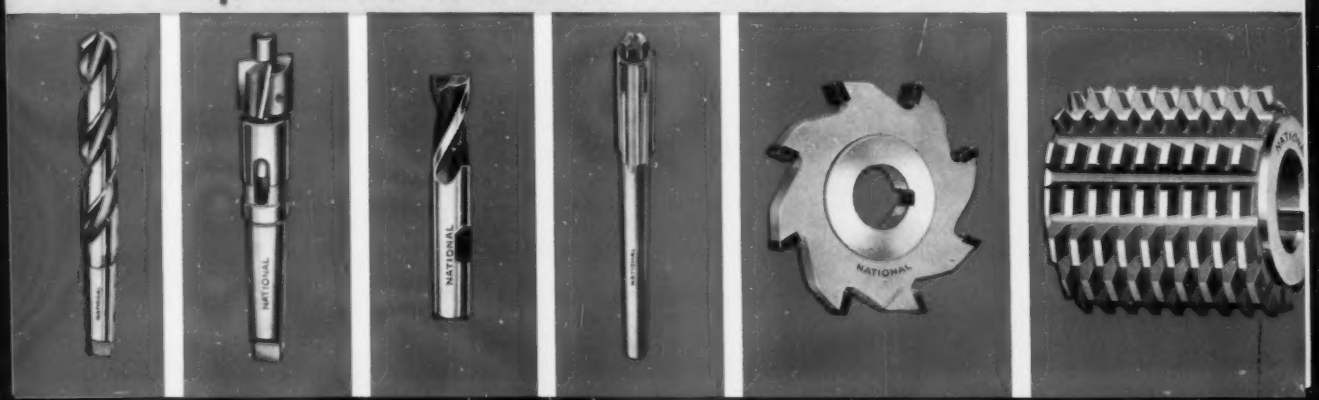
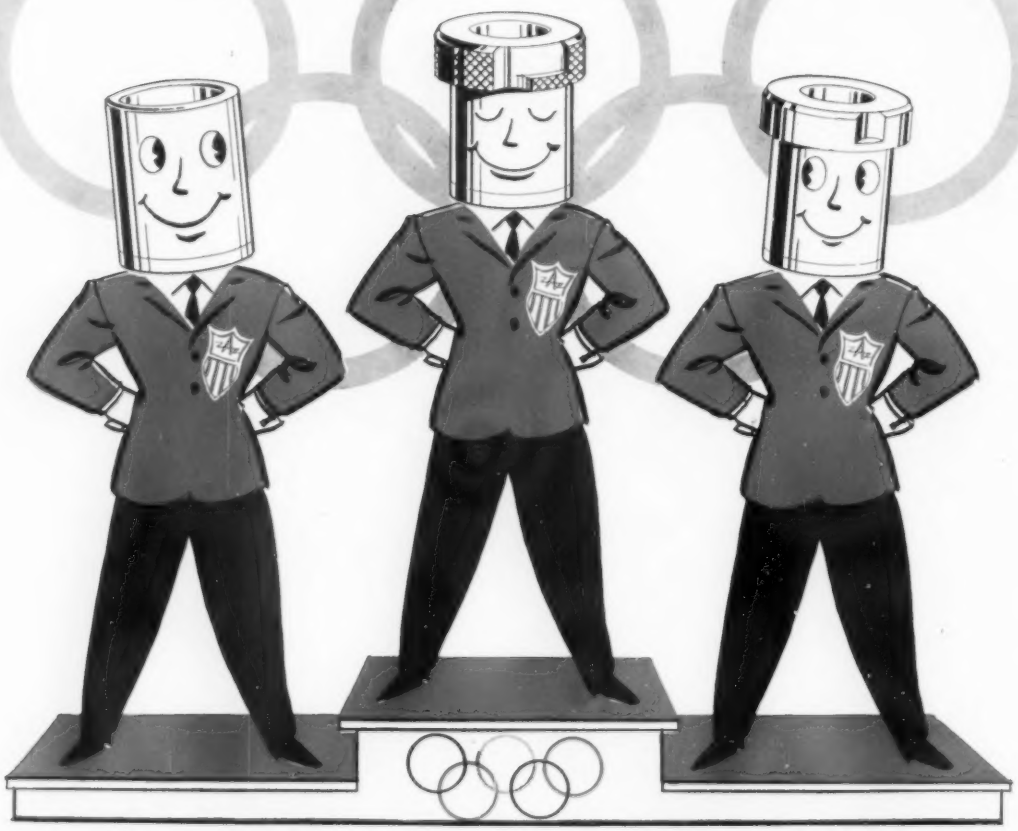


CHAMPIONS!



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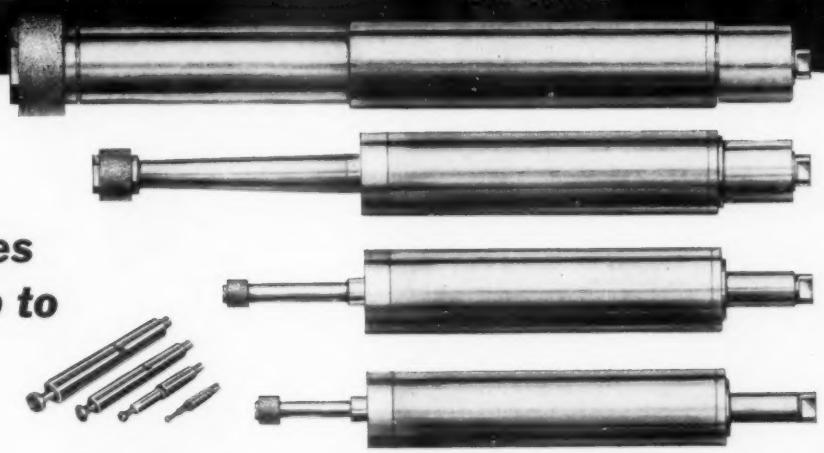

with important new features that add up to

TOLERANCES TO MILLIONTHS

super-precision bearings made to Pope specifications and used exclusively in Pope spindles

total eccentricity of shaft, measured in the tapered hole, will not exceed 20 millionths (.000020)

Assembled spindles are dynamically balanced with all rotating parts in full assembly to 25 millionths (.000025) amplitude of vibration. This assures low micro-inch surface finishes.

INCREASED PRODUCTION

Pope Spindles have the rigidity and the ability to take heavy cuts and produce uniform parts.

LOWER OPERATING AND MAINTENANCE COST

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Saved operating time — one motor driving pulley serves all spindles in most cases.

Permanent lubrication — Pope system of grease lubrication prolongs bearing life, minimizes maintenance expense, and the spindles run cool.

New concealed centrifugal air flow coolant repelling flinger increases bearing life and reduces maintenance expense.

Ask for Catalog No. 57-A and Bulletin No. WA-10, or send us your specifications on the spindles you require.

No. 128

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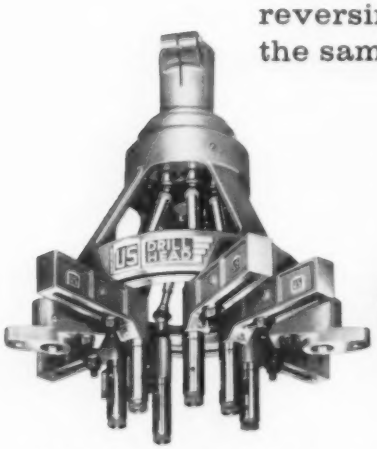
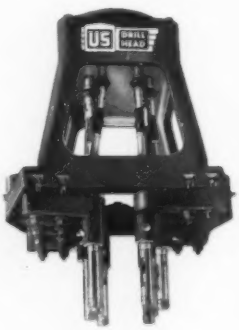
or production runs . . . drilling only or drilling and tapping*. . . you can't beat the profit-making performance designed and built into universal adjustable **U.S. DRILL HEADS**

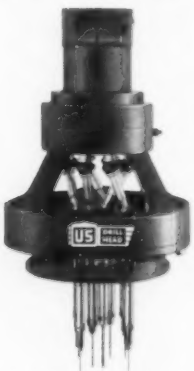
*When your drilling machine has a reversing spindle, you can drill and tap the same hole pattern with one head



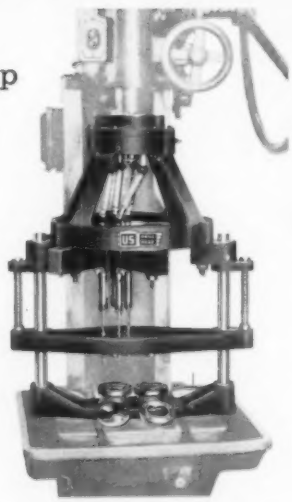
Style U Heads are built in 8 standard models — positive all-gear drive with shaved gears, antifriction bearings, and neoprene covered, lubricated quick-change joints—smooth, quiet, accurate.



Special head designs for single-purpose machines afford the flexibility of U. S. Drill Head's universal drives.



Slip Spindle Plates, used in place of the adjustable brackets, may be jig-bored to drill more than one pattern of holes.



Holding fixtures with guide bushing plates may be used for drilling two different workpieces at the same time, or to accommodate different hole patterns with a minimum of fixtures and setups. Guide bars maintain alignment.

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Adjustable and Fixed Center Multiple Drilling Heads.
Individual Lead Screw Multiple Tapping Heads.

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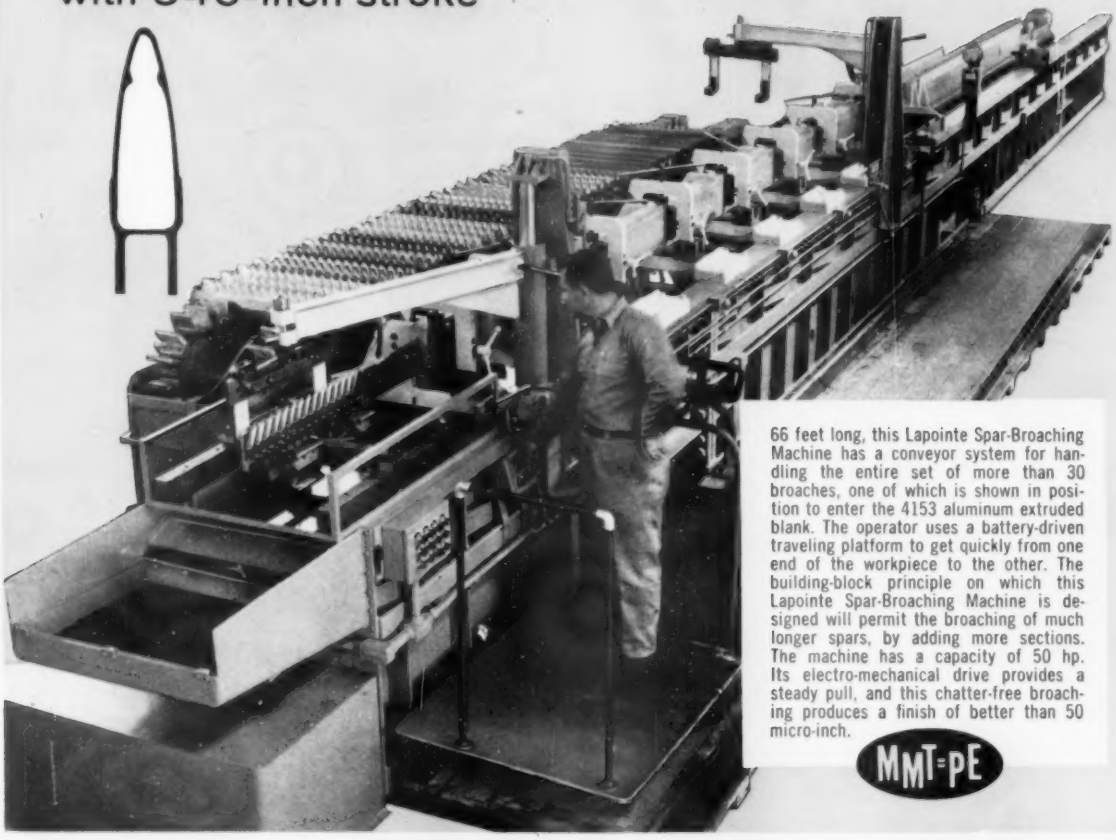
Ask for Catalog AD-57, or send specifications of your requirements.

The longest hole ever broached is in this 24-foot helicopter blade . . . and it's broached on the LAPOINTE SPAR-BROACHING MACHINE with 340-inch stroke



66 feet long, this Lapointe Spar-Broaching Machine has a conveyor system for handling the entire set of more than 30 broaches, one of which is shown in position to enter the 4153 aluminum extruded blank. The operator uses a battery-driven traveling platform to get quickly from one end of the workpiece to the other. The building-block principle on which this Lapointe Spar-Broaching Machine is designed will permit the broaching of much longer spars, by adding more sections. The machine has a capacity of 50 hp. Its electro-mechanical drive provides a steady pull, and this chatter-free broaching produces a finish of better than 50 micro-inch.

MMT=PE

Everybody seems to come to Lapointe when in need of help on unusual broaching problems. And broaching the inside contour of the 24-foot extrusion was a *real problem* . . . it had never been done before.

Now that it has been done, the all-metal spar is destined to replace the conventional fabricated spar and provide many production and structural advantages, including much longer life of the spar.

Maybe your shop is producing a part that could be improved by broaching — or perhaps the production time could be substantially reduced. Why not find out? An experienced Lapointe Field Engineer will gladly discuss any metal-removing problem with you.

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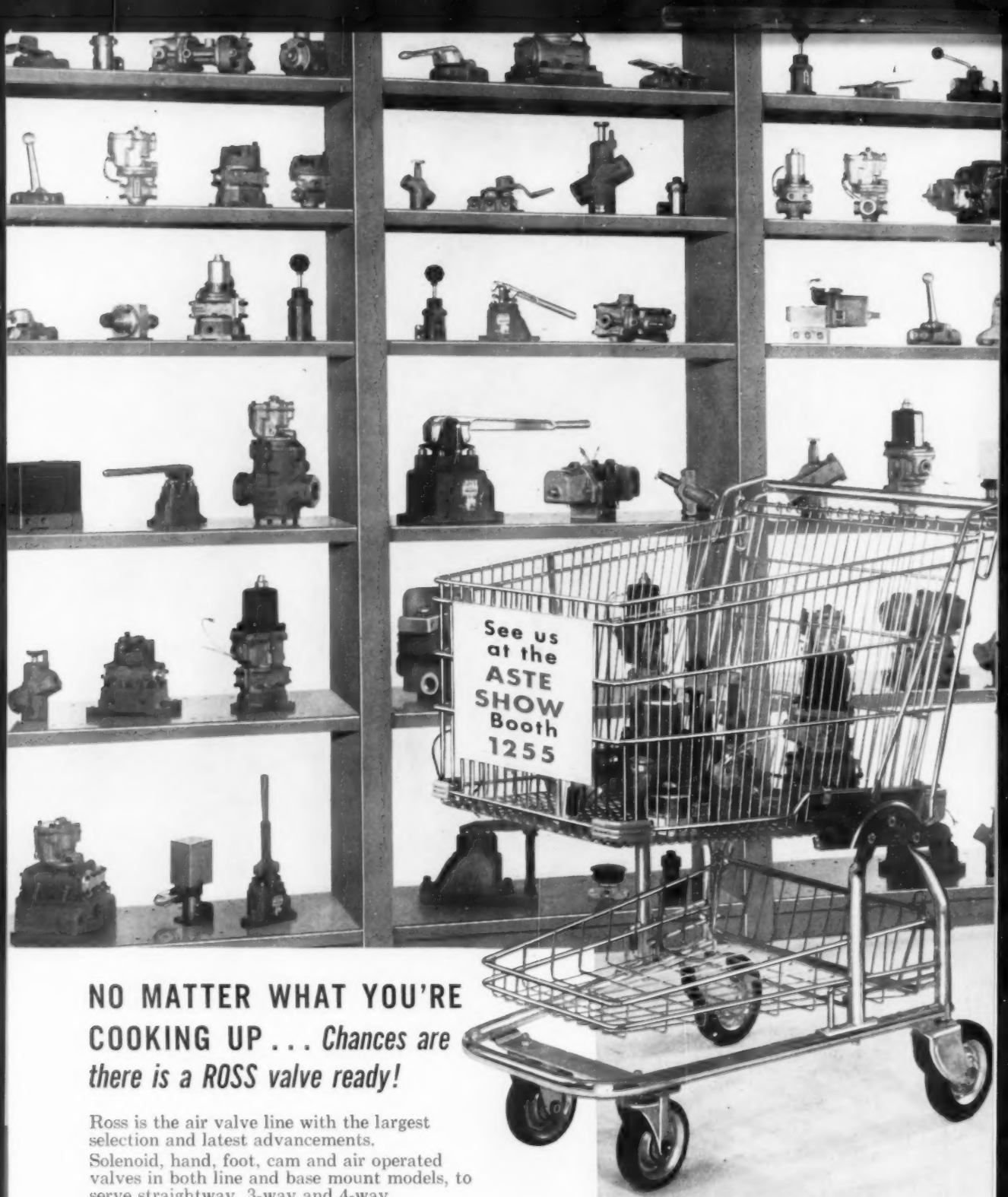

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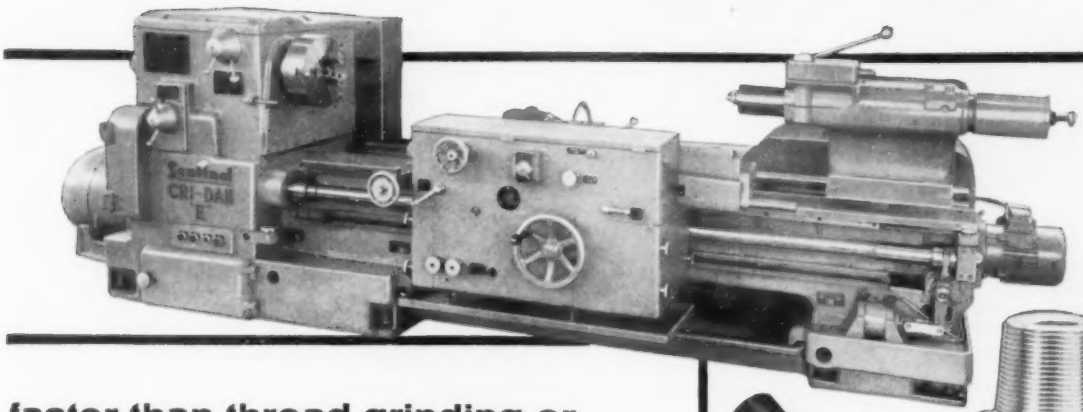

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Widely used throughout Europe and rapidly gaining favor in the U.S.A., CRI-DAN High-Speed Threading Lathes offer outstanding advantages on a wide variety of threading work. Using single-point carbide tools and positive, cam-controlled movements, CRI-DAN provides very accurate lead and thread form on all types of internal and external threads, including multiple-start, coarse, fine, left- or right-hand, parallel or taper, with metric or inch pitches. Highest production, accuracy and fine finish are assured on even the most difficult materials.

With simple operation and 15 minute change-over, CRI-DAN is an extremely versatile machine capable of handling an amazing range of components at high production rates. Single-point carbide tools, easily resharpened or replaced, cut tooling costs to a minimum.

Two models are available with a full complement of accessories to meet your needs. Ask your Gisholt Representative for full details or write

GISHOLT MACHINE COMPANY
Madison 10, Wisconsin

Investigate Gisholt's Extended Payment and Leasing Plans

Turret Lathes • Automatic Lathes • Balancers • Superfinishers Threading Lathes

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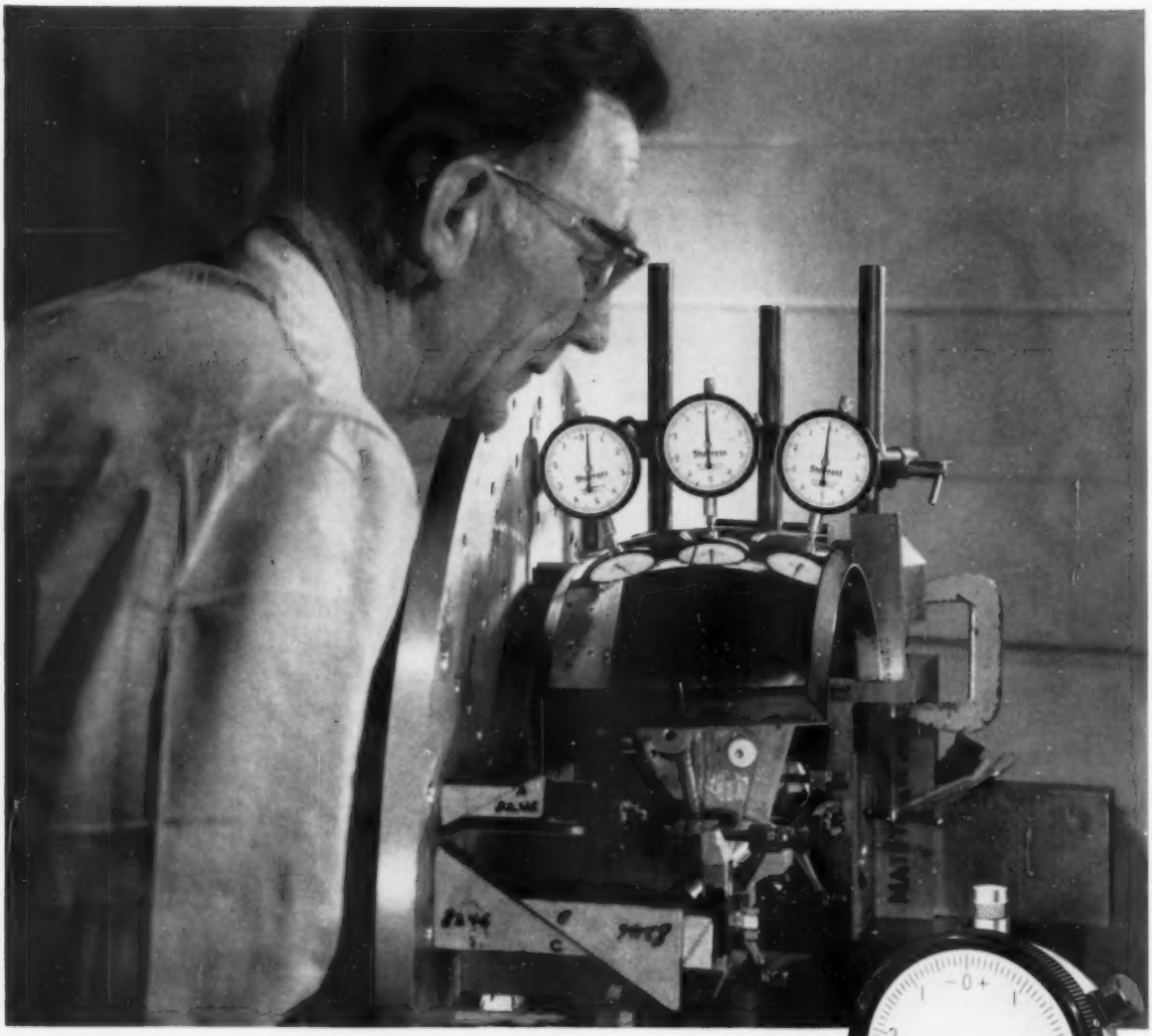

STARRETT High Precision-Low Friction DIAL INDICATORS

guarantee accuracy, long life, easy maintenance, low upkeep cost

Longer life for dial indicators through high precision, low friction design that keeps them on the job . . . lowest maintenance cost through simple, interchangeable construction that sharply cuts upkeep time (same gear unit fits all Nos. 25, 655 and 656 series indicators) . . . easy-reading accuracy and smooth, consistent performance through super-sensitive, low friction, low inertia movements that make gaging completely reliable . . . plus the advantage of buying all dial indicators and gages from one dependable source.

These are the benefits you get when you specify Starrett High Precision-Low Friction Dial Indicators — the world's most complete line. Your nearby Industrial Supply Distributor has them in regular, non-shock or anti-magnetic types — English or Metric reading — over 140 models including four AGD series plus long range. Call him for quality products, dependable service. Or write for Starrett Dial Indicator and Dial Gage Catalog which shows the complete line. Address Dept. E, The L. S. Starrett Company, Athol, Mass., U. S. A.

Application at Raytheon Company Wayland Laboratory

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World's Greatest Toolmakers

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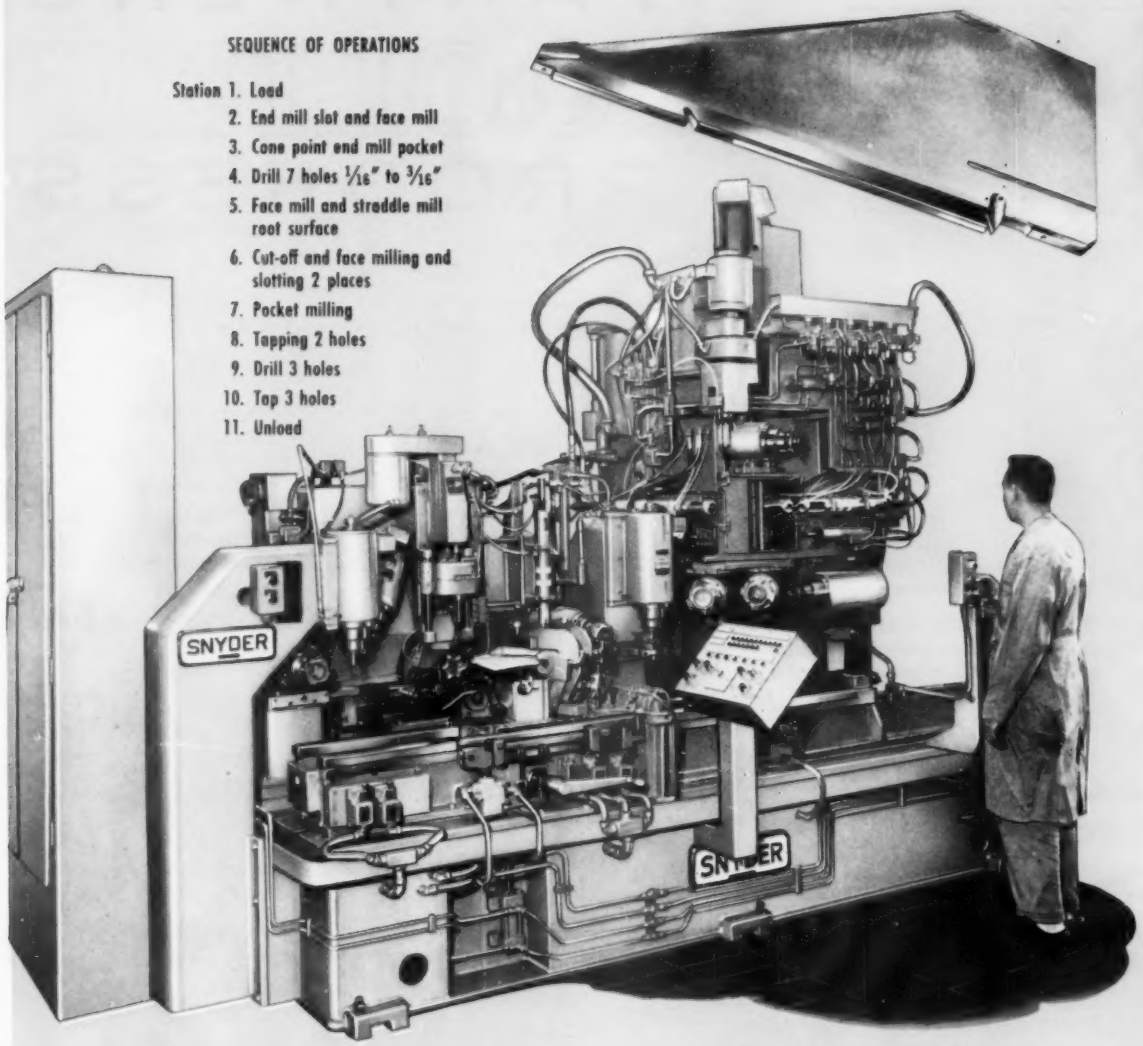
SEQUENCE OF OPERATIONS

Station 1. Load
2. End mill slot and face mill
3. Cone point end mill pocket
4. Drill 7 holes 1/16" to 3/16"
5. Face mill and straddle mill root surface
6. Cut-off and face milling and slotting 2 places
7. Pocket milling
8. Tapping 2 holes
9. Drill 3 holes
10. Tap 3 holes
11. Unload



COMPLEX MISSILE WING GETS 24 PRECISION OPERATIONS IN SPECIAL SNYDER PROGRAMMING TOOL

at Martin Company's Baltimore Division

Production rate, tolerances and part configuration dictated the fundamental design concept of this exceptionally compact tool which has 11 stations and performs 24 operations.

The cycle can be automatic, semi-automatic or manual. Controls for multiple cycle operations are provided by utilizing basic circuits triggered by a programming control device.

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CORPORATION
(Formerly Snyder Tool & Engineering Company)

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Phone: LO 7-0123

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PARTNERS in TOOLING PROGRESS

ASTME PURPOSE: To use, as tooling engineers, the very latest and best practical method, technique or process to build the best product at the lowest possible cost.

True to their aim to "build the best product at the lowest possible cost", Society members have — in ever increasing numbers — adapted plastics to supplement their tooling programs. Ren is proud of its association with the members of this progressive Society who are constantly alert and receptive to new methods and products for improving the tooling industry.

Increasing applications of epoxy plastic tools and dies for production tooling attests to the fact that plastics have truly come-of-age as a recognized tooling medium. Ren takes pardonable pride in pointing to the fact that many of today's advanced plastic tooling techniques and products have originated in the Ren laboratories.

Research is a byword with Ren. Our staff of research chemists constantly formulate, analyze and test the latest developments in epoxy plastics chemistry in their research to develop new and better compounds — and improve present Ren products.

REN PURPOSE: To provide, wherever possible, the materials and techniques necessary for tooling and manufacturing engineers to achieve their purpose.

We are proud to announce two important new products developed as a result of Ren's constant research for improved methods and materials —

REN SHAPE is a fast curing epoxy resin based paste material featuring dimensional stability. REN SHAPE is the perfect answer — as a substitute for Plaster of Paris — as a quick effective method for building and duplicating male and female parts — as a fillet material — for rebuilding or repairing obsolete or damaged patterns.

Ren Shape Application

REN WOOD is modern chemistry's answer to the many inherent disadvantages of mahogany and impregs as pattern and model making materials. Of highly stable and imperfection-free texture, REN WOOD is warp-free and may be carved, sawed, chiseled, planed or shaped with conventional tools. Resistant to impact deformation and of uniform density, REN WOOD is a marked improvement on nature's own pattern making materials.

Ren Wood

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plastics, incorporated
lansing 9, michigan

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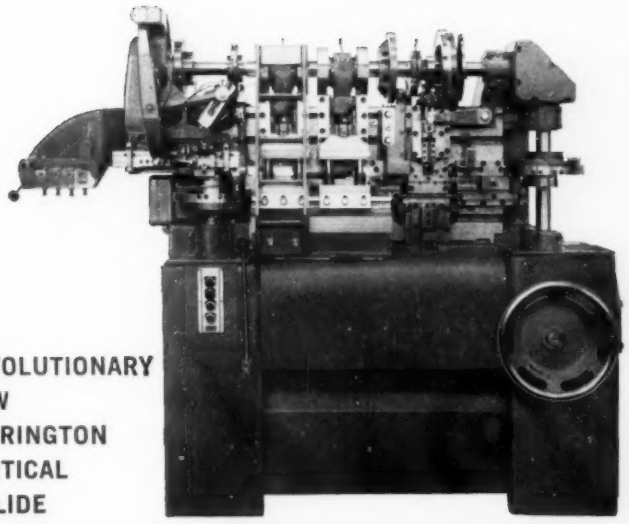
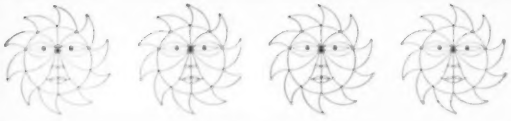
ASTE TOOL SHOW

See the many advantages of these important new Ren products demonstrated at Booth 1517.



REVOLUTIONARY NEW TORRINGTON VERTICAL 4-SLIDE



PAID FOR ITSELF IN FOUR DAYS

PRODUCING THIS PART

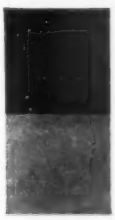
Close-tolerance enameling wiper die . . . having 26 critical dimensions . . . produced by General Electric Industrial Heating Dept.

AT FOUR TIMES THE SPEED

With one machine replacing five progressively tooled OBI presses . . . and producing the part in one-fourth the time.

AND ONE-THIRD THE COST

Saving $13,500 on a single production run of only three days duration!



This important new production tool, the Verti-Slide, offers sensational savings in direct and indirect labor costs, parts inventory, and floor space requirements . . . through elimination of secondary operations, drastic reduction in production man-hours, and lower tooling, down-time and materials handling costs. Write or call today for complete technical data . . . or a Torrington sales engineer.

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G.E. turns motor shafts to close tolerances, cuts operating

GULF MAKES THINGS

A dual purpose Gulfcut oil has enabled General Electric to achieve significant operating economies without sacrifice of machine speed or performance.

Gulfcut 41B—a sulfo-chlorinated-lard oil—is used by G.E. as the cutting fluid in their Conomatic bar machines, for machining four different sizes of motor shafts. Turned from C1212 steel at a spindle speed of 112 rpm, these motor shafts must be held to close tolerances to meet the company's high standards of product quality. G.E. reports that with Gulfcut oil they not only maintain exacting tolerances, but also get fine finishes and longer tool life.

In addition, G.E. gets effective lubrication of the headstocks and other parts of their 8-spindle Conomatics with Gulfcut 41B—a truly versatile oil.

Whatever the type of machining you do, there's an oil in the complete Gulfcut line to meet your every need. Call a Gulf Sales Engineer at your nearest Gulf office, or send for your free copy of "Metal Machining with Cutting Fluids," 116 pages on their selection and use.

Gulfcut oil enables 8-spindle Conomatics at General Electric, Linton, Indiana, to cut motor shafts to fine tolerances; helps give them precision finishes.

Carl B. Beyerlein (right), supervisor of planning, G.E., Linton, Indiana, discusses machining problems with M. S. Ringo, Gulf Sales Engineer.

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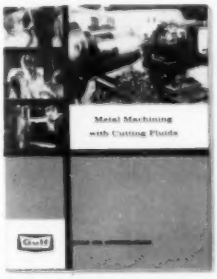

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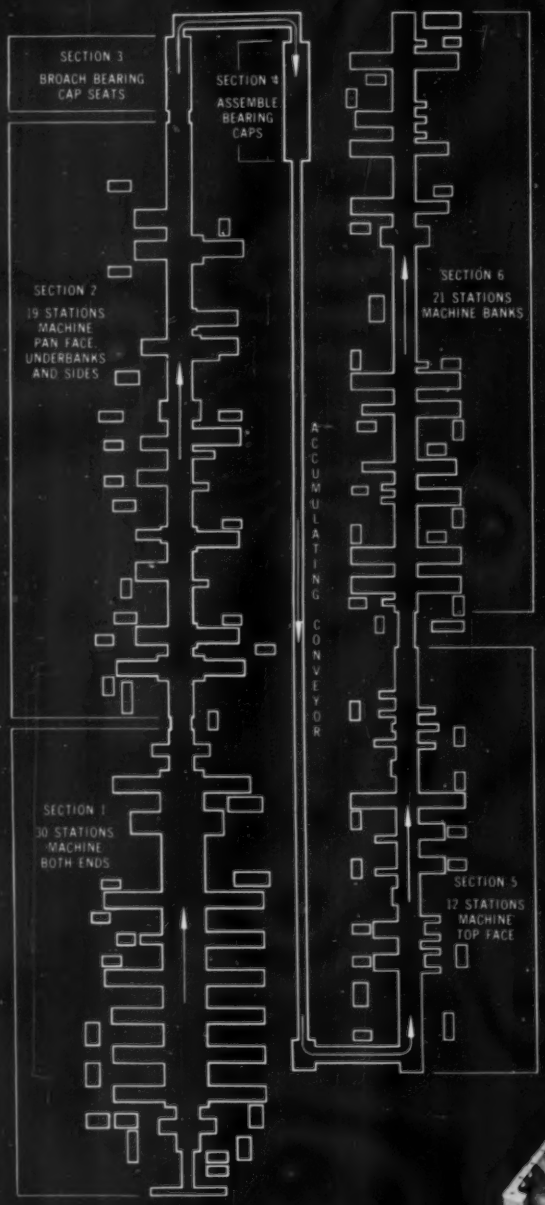
V-6 and V-12 Engine Blocks Processed on ONE Transfer-matic



Floor plan layout of the sectionized Transfer-matic. The illustration on the right is Section 1 and 2.

New concepts of production flexibility are engineered into this new Sectionized Transfer-matic created to machine engine blocks for a new family of large V-6 and V-12 truck engines. 579 boring, reaming, tapping, chamfering and spotfacing operations are performed on the V-6 parts and 901 on V-12's. Of these, 454 are common to both parts.

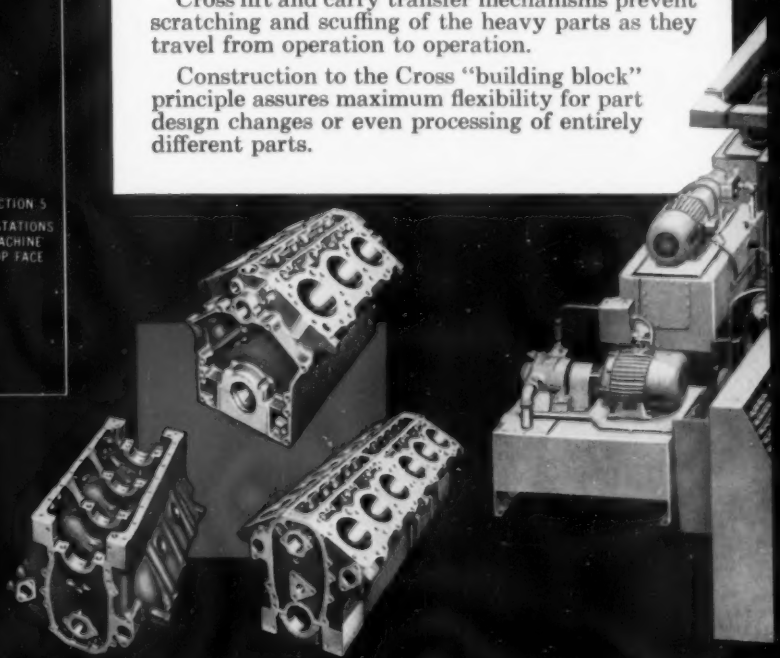
The uncommon operations are taken care of with standby spindles and machine units, and with a novel two-step transfer mechanism which reduces the number of spindles required to machine the V-12 by approximately 50%. The transfer mechanism, where applied, allows the V-12 to make two stops under each multiple head (heads have only enough spindles to process the V-6). At the first stop, the front half of the V-12 is machined, and at the second stop, the rear half. V-6's move through the machine in a conventional manner stopping under each head only once.

Capacity of the line operating at 100% efficiency is 65 V-6 blocks per hour, or 35 V-12's.

The line is divided into sections with provisions for banking between each section. Thus, it is possible to be producing V-6's in some sections, V-12's in others and to be making a changeover in still another section, all at the same time.

Cross lift and carry transfer mechanisms prevent scratching and scuffing of the heavy parts as they travel from operation to operation.

Construction to the Cross "building block" principle assures maximum flexibility for part design changes or even processing of entirely different parts.



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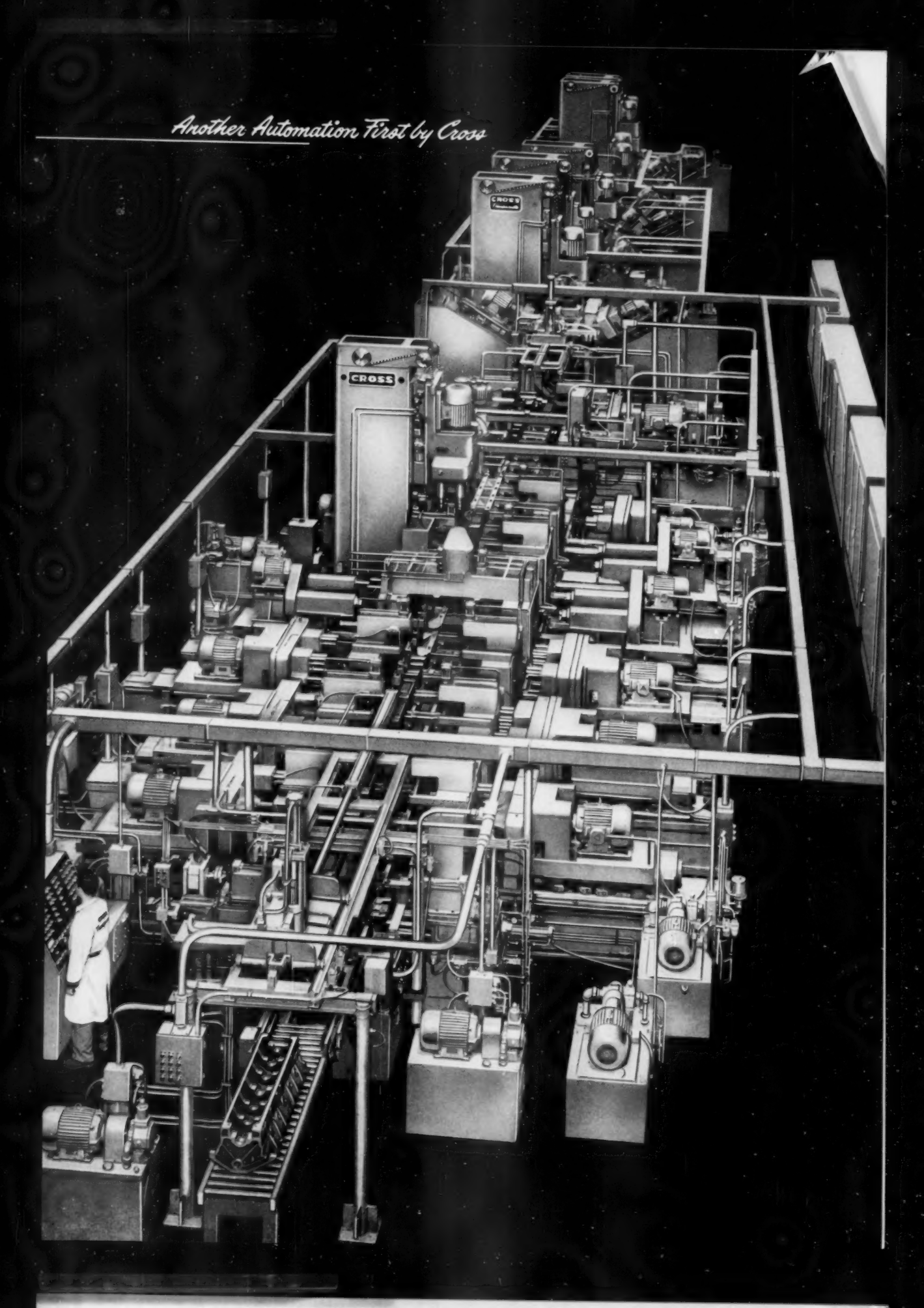
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Greater ease in cutting and longer life are the outstanding features of these Weldon tools for countersinking and deburring operations.

Chatter is eliminated because of the single cutting edge.

A trial will convince you.

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Catalog list numbers are now marked on all Weldon tools and holders as an aid when reordering . . . another WELDON FIRST.

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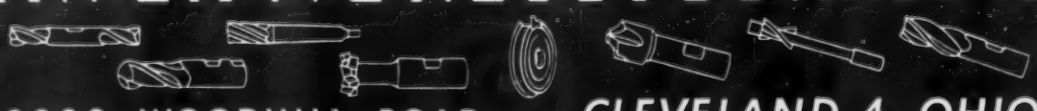

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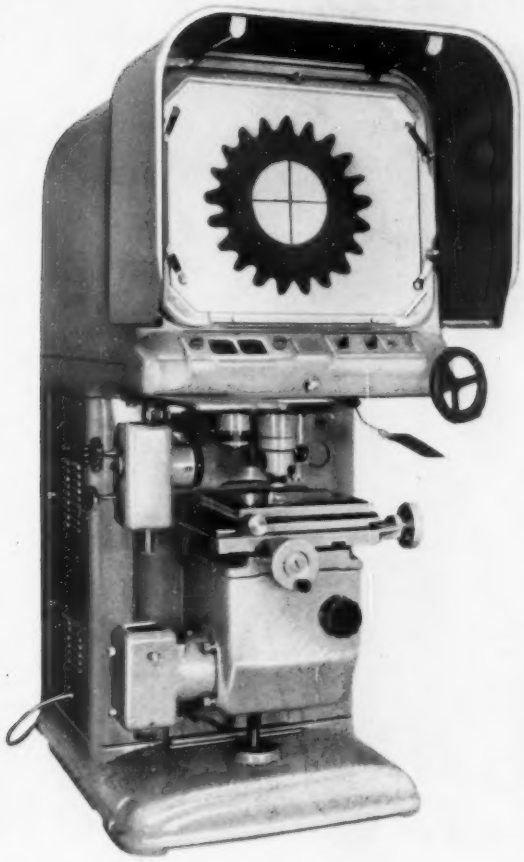


announcing
the New Model 5A

NIKON OPTICAL COMPARATOR

with large screen
18 x 22 inches

A large-screen optical comparator may be no great innovation. But, when a large screen has the illumination brilliance which Nikon has brought to comparators; and the sharpness and edge-to-edge resolution which Nikon comparator lenses have demonstrated; this announcement begins to assume new importance.

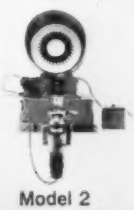
The new Nikon 5A is probably the most advanced optical comparator in the field today. As in the case of other Nikon comparators, the 5A has facilities for surface as well as contour measurements and inspection. And for surface inspection, Nikon does not limit you to conventional oblique lighting. Nikon half-reflecting mirrors, available for each of the comparator lenses, provide vertical, shadowless surface illumination on the optical axis. The elimination of shadow permits greater accuracy in making surface measurements. This is further aided by the brilliance achieved in surface illumination because of the extreme speed or light transmission of Nikon lenses.

The Nikon 5A also features a telecentric 4-lens turret. A twist of the turret changes the magnification. And the image remains in exactly the same screen position for each lens.

Focusing with the 5A is completely effortless, and virtually automatic. Two instantly reversible motors drive the counterbalanced stage carriage —raising or lowering it, as required. The motion is smooth and steady. One motor provides the fast motion for coarse focusing, and the other operates the carriage for fine focusing. Cut-out micro-switches at the extreme travel limits of the carriage automatically shut off the motors.

A wide assortment of accessories is available: cross-moving and revolving micrometer stages of every conceivable design, including a stage with optical reading, also holding fixtures, protractor screens, charts and photo accessories.

Other
NIKON OPTICAL COMPARATORS



Model 2

Model 3

Model 6

See the complete line of Nikon Optical Comparators, Microscopes, Auto-Collimators and other Nikon optical inspection equipment at the ASTE Show — Booth 607.

for complete details, write to:
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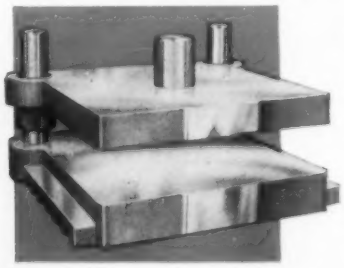
WE'LL SEE YOU IN DETROIT...

BOOTH 1439

THE *Exclusive* SET

Along about this time every year, we begin to travel. And, this year, there's no better place to go than to the A.S.T.M.E. Show . . . so we're on our way to Detroit, bag and baggage, with a lot of Superior exclusive die sets we want to show to all the A.S.T.M.E'rs.

Shhhhh! Can you keep a secret? We like tool and manufacturing engineers. Know why? Because they like Superior die sets — with the exclusive features. See Superior . . . the exclusive set! And we'll be seeing you!



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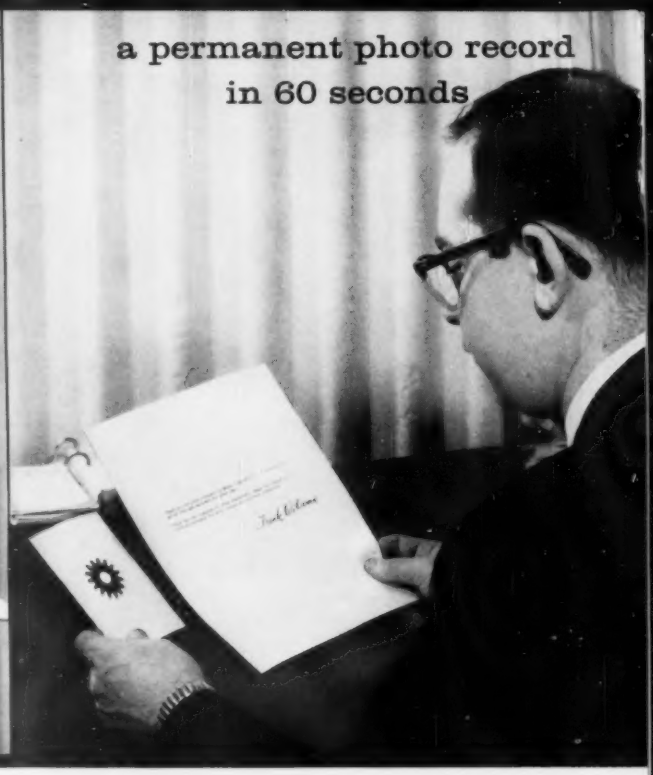

NIKON OPTICAL COMPARATOR
equipped with a
POLAROID® LAND FILM HOLDER

For gaging, measuring, inspecting, or even assembling precision parts, there's nothing to beat the ease, the speed and accuracy of a Nikon Optical Comparator.

What could be simpler! A part is placed on the stage, or secured in a holding fixture, and its magnified image is projected onto the screen with every detail brilliantly, clearly and precisely shown. Several people can view it simultaneously. Measurements can be made directly on the screen, and precise comparisons made with Master charts or drawings.

A Nikon Optical Comparator can be used to inspect the most intricate shapes and forms with complete ease—where other gaging methods are impossible. Even surface contours and finishes can be inspected and measured. This versatility is further extended by the availability of a wide assortment of accessories including: lenses of many magnifications—stages—fixtures—charts—protractor screens—and photo-recording equipment in any size from 35mm to 5 x 7—for black and white or color.

For shop files, for immediate or future reference, for a simple explanation of details, for clarification of technical reports or other inter-office communications, nothing beats the graphic power of a photograph to communicate accurately and effectively. A 60-second Polaroid picture showing a part exactly as the inspector saw it on a Nikon comparator is more reliable than a 1000-word memorandum—takes less time, and is less likely to be misunderstood or misinterpreted.

Taking pictures with the Polaroid Land Film Holder requires no special skill or training, and no special lighting or room conditions. You insert the holder into the photo back, pull the protective dark-slide, turn on the comparator light for the exposure—and that's it. 60 seconds later you have a permanent 4 x 5 print for your use.

The Polaroid Land Film Holder is another example of the many ways a Nikon Optical Comparator can serve you in your shop or plant—cut costs, save time and increase inspection efficiency.

At the ASTE Show in Detroit you will see these tools in actual use, and judge for yourself how much a Nikon Comparator can do for you—in screening components, checking line production, assembly, and in final quality control — all at moderate cost.

Bring a specimen part from your shop to the show. Let us demonstrate the Nikon inspection procedure right before your eyes. We will present you with a 60-second mounted Polaroid picture of your specimen part, at no charge. See us at Booth 607.

For illustrated catalog, complete specifications, and prices of all units and accessories, write to:

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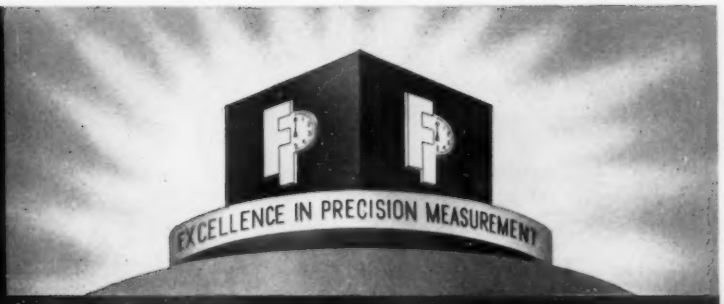

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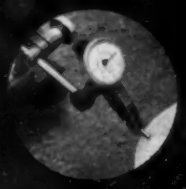

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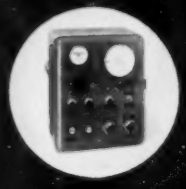

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- Increases output 27%
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- Electronic work-positioner for universal grinders
- Saves over 50% in job set-up time
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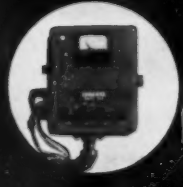

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... the instrument that gives you for the first time ... a greater combined accuracy and continuous operating range than

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Clausing-Colchester 13″, 15″ and 17″ lathes are by long odds the greatest values in lathe history. Note the following outstanding superiorities and rock-bottom prices:

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● **BIG SPINDLES WITH LARGER THRU-HOLE CAPACITY:**

LATHE	17″	15″	13″
THRU-HOLE	3″	2″	1½″
NOSE TAPER KEY DRIVE	L-2	L-1	L-0

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● **INDUCTION-HARDENED BED WAYS** . . . Standard equipment at no extra cost!

● **ALL-GEARED HEADSTOCK** . . . Gears are induction hardened.

● **OIL BATH LUBRICATED HEADSTOCK and QUICK CHANGE GEAR BOX** . . . both totally enclosed.

● **SEPARATE FEED ROD FOR POWER FEEDS** . . . Lead screw is used for thread cutting only.

● **LOWEST PRICES** . . . The Clausing-Colchester is the biggest lathe value you can find anywhere! The 13″ straight bed model starts at $2302; 15″—$3221; 17″—$5070. Gap bed models are available in all three sizes. *Prices include 2-speed motor and American electricals.*

Get all the facts. Compare Clausing-Colchester with any other lathes of comparable size . . . feature for feature, dollar for dollar. Prove to yourself that Clausing-Colchesters are truly the "Greatest Values in Lathe History" . . . *the* lathes for *your* shop!

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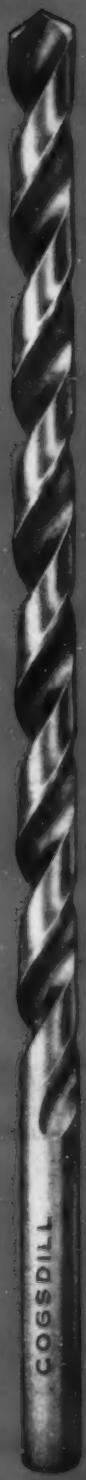
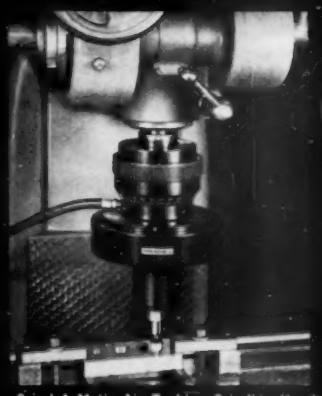
THREADWELL QUALITY TOOLS NOW

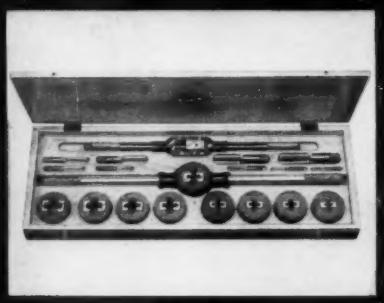
The man who uses Threadwell tools knows that with us, quality is more than a hackneyed word. He knows that every Threadwell product is made by highly skilled craftsmen who are fully aware of the responsibility which is theirs in the production of the highest quality tools. They work with the finest in materials and equipment. Moreover it is a policy of long standing that every Threadwell product is given a continuous process inspection at each step of its manufacture, and is not stamped with the Threadwell name until it undergoes a comprehensive final inspection.

INCLUDE COGSDILL TWIST DRILLS

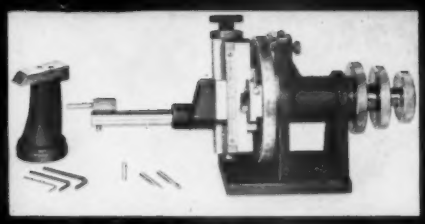




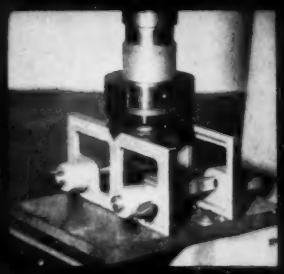
Grind-A-Matic Air Turbine Grinding Head



Threadwell Tap & Die Kit



Tangi-Matic Direct Reading Dresser



Little Champ Adjustable Parallels

Threadwell takes pleasure in announcing that arrangements have been completed to manufacture and distribute the quality line of Cogsdill drills. This development is in strict keeping with Threadwell's position as a leading supplier of quality tools for the metal-working industry. Cogsdill is a respected name wherever it has been used, and Threadwell will continue to market these drills under the Cogsdill brand name. The industrial user as a result will get a big bonus . . . the finest drills made backed by Threadwell's reputation and serviced by Threadwell's Distributors and outstanding staff of cutting tool experts and field engineers.

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THE RIGHT HAND OF PRODUCTION

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In CASE after CASE after CASE after CASE

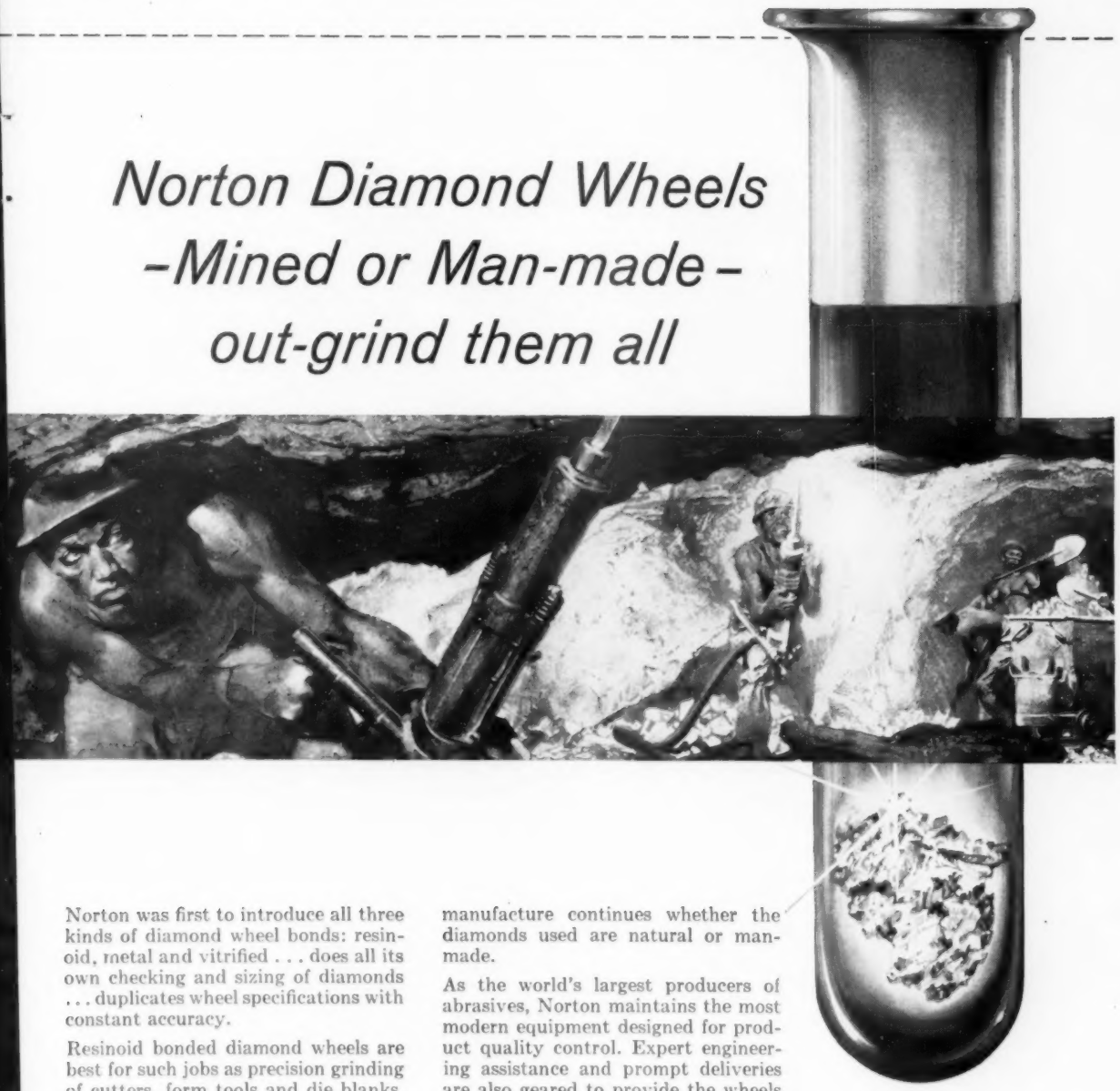
An automobile manufacturer in Michigan used Norton natural diamond wheels with resinoid bond, size 3¾ x 1½ x 1¼, type D11V9 for dry sharpening carbide tipped broaches. Compared to a competitive diamond wheel of similar specifications, the Norton wheel removed stock at a cost of $25.36 per cubic inch of carbide. Stock removal costs for the competitive wheel were $34.50 per cubic inch. The Norton wheel reduced grinding costs 26.5%.

A mid-western manufacturer of small gasoline motors used a Norton resinoid wheel having man-made diamond abrasive, size 6 x ¾ x 1¼, type D6A2C to wet-grind single point carbide tools. These Norton wheels, compared to another brand of similar type and description, provided twice the life of the competitive product.

A mid-western manufacturer of machine tools ran Norton resinoid wheels, of mined diamond, size 6 x ½ x ¾ type D6A9 against a competitive wheel of comparable type and description for the dry grinding of carbide milling cutters. The Norton wheel lasted 521 hours compared to 300 hours for the other wheel. The Norton wheel provided 73.6% more usable life.

A western producer of aluminum used Norton resinoid-bonded diamond wheels of man-made abrasive to dry-grind carbide milling cutters. Wheel size was 5 x 1¾ x 1¼, Norton type, D11V9. Previously, the customer had been using a competitive wheel of similar specifications. The Norton wheel, compared to the other brand, cut faster and had twice the useful life.

Norton Diamond Wheels –Mined or Man-made– out-grind them all



Norton was first to introduce all three kinds of diamond wheel bonds: resinoid, metal and vitrified . . . does all its own checking and sizing of diamonds . . . duplicates wheel specifications with constant accuracy.

Resinoid bonded diamond wheels are best for such jobs as precision grinding of cutters, form tools and die blanks. They are available in several bond types — B type for wet grinding — B6 type for dry grinding.

Vitrified bonded diamond wheels are used for sharpening single-point cutting tools, grinding chip grinders and for surfacing carbide dies.

Metal bonded diamond wheels are sometimes preferred for grinding chip breakers, for certain offhand grinding jobs and for cutting off sintered carbide blanks, etc.

Norton leadership in diamond wheel manufacture continues whether the diamonds used are natural or man-made.

As the world's largest producers of abrasives, Norton maintains the most modern equipment designed for product quality control. Expert engineering assistance and prompt deliveries are also geared to provide the wheels you need for top quality, lowest cost carbide grinding. For these helpful services, see your Norton Abrasive Engineer or Norton distributor. Or write to NORTON COMPANY, General Offices, Worcester 6, Mass. Plants and distributors around the world.

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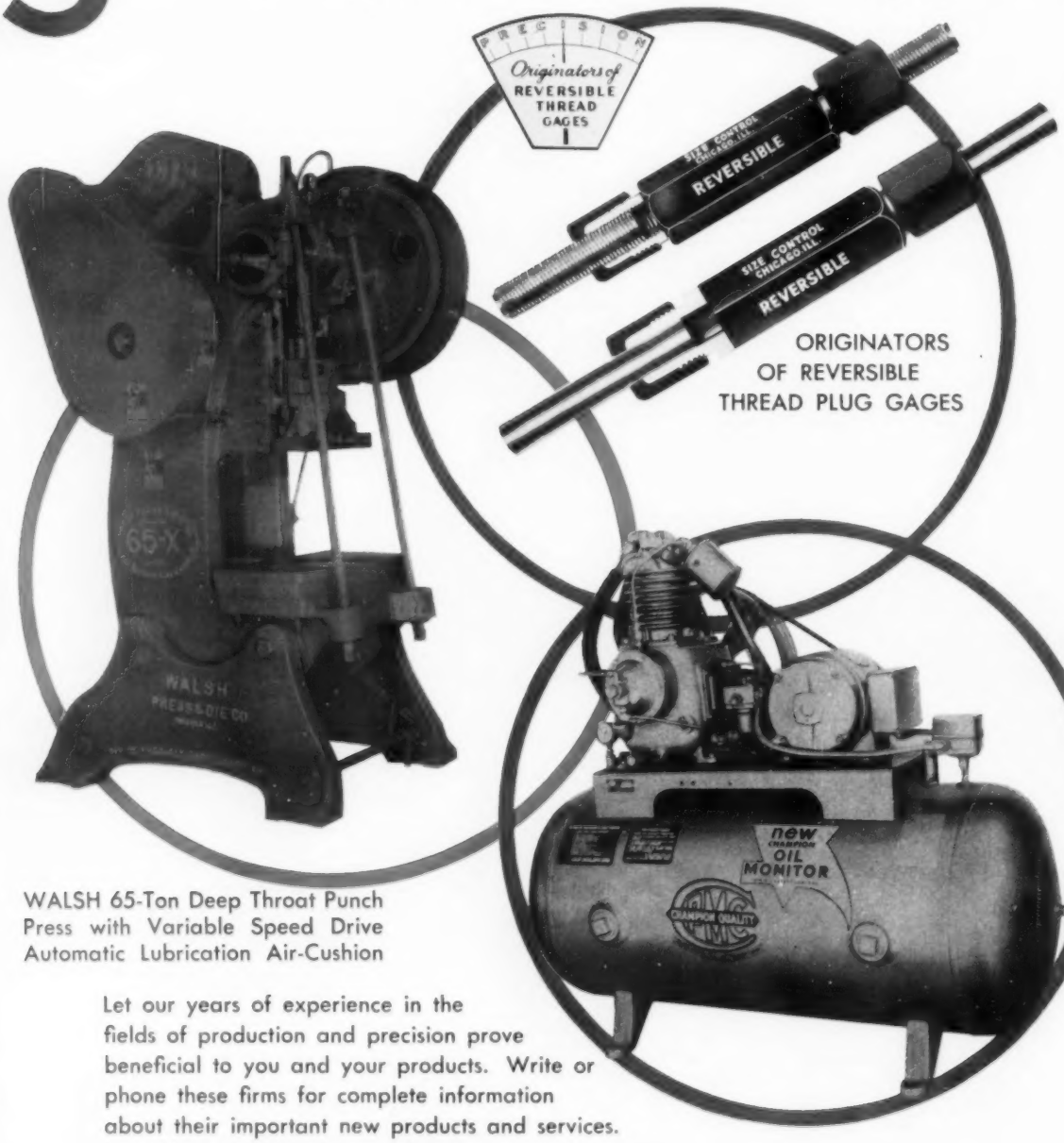
75 years of . . . **Making better products . . . to make your products better**

NORTON PRODUCTS: Abrasives • Grinding Wheels • Machine Tools • Refractories • Electro-Chemicals — **BEHR-MANNING DIVISION:** Coated Abrasives • Sharpening Stones • Pressure-Sensitive Tapes

3 to solve your manufacturing problems



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CHAMPION Two-Stage Automatic Horizontal Compres OEH 38 with Exclusiv OIL MONITO (low oil le safety contr

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Photo: Courtesy Isaacson Iron Works Co., Seattle, Washington

P&H PRECISION CONTROL SPOTS HEAVY STEEL ACCURATELY, SAFELY

This West Coast steel-fabricating company depends on P&H Balanced Design Hevi-Lift hoists to keep heavy steel beams and fabricated structures moving through its shops.

Note the unique method of installation which provides a high degree of flexibility . . . hoists can be used alone — or hoists can be teamed up to handle extra-long sections.

This company selected P&H Balanced Design Hevi-Lifts because they will stand up longer, under heavier duty cycles — with less maintenance — than any other hoist they could buy. Reason: Balanced Design means that every component has been balanced with every other component for maximum strength and performance characteristics.

If uninterrupted through-the-air material handling is important to you, too, then it will pay you to find out more about these new hoists. Send for bulletin H-55, Dept. 222, Harnischfeger Corporation, Milwaukee 46, Wis.

HARNISCHFEGER
Milwaukee 46, Wisconsin

P&H
HEVI-LIFT HOISTS

See us at Booth 1930 at The Tool Show!

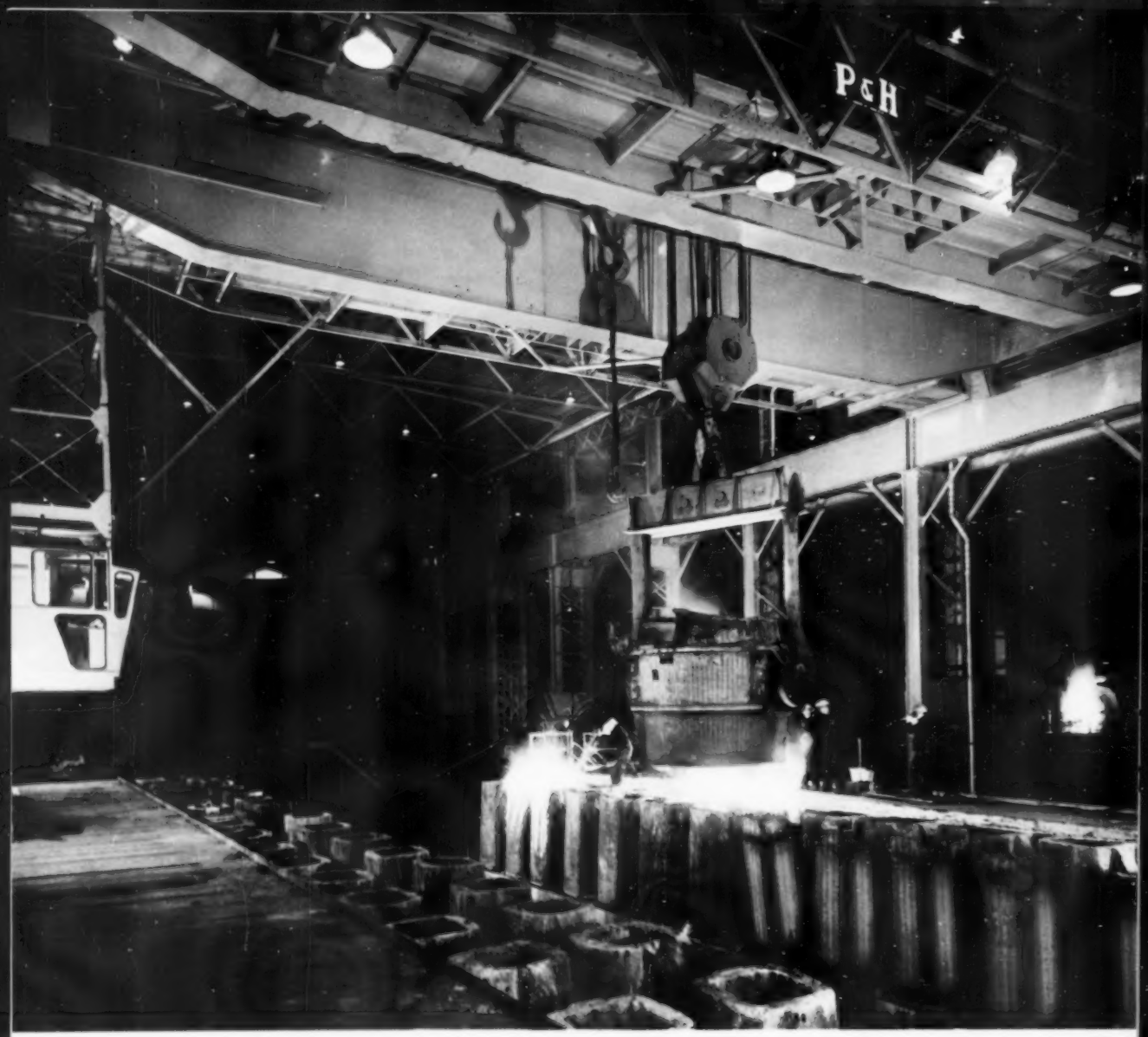


Photo courtesy Acme Steel Company, Riverdale, Illinois.

FOR EVERY APPLICATION, THERE'S ONE CRANE OUTSTANDING...

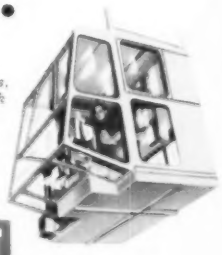
IN STEEL MILLS: This 100-ton P&H crane lifts, transports and "spots" tremendous loads of molten steel as surely and deftly as you handle a coffee cup.

P&H steel mill cranes perform tasks like this effortlessly and dependably because they are specifically designed for steel mill service . . . to handle massive loads, withstand searing heat, ignore frequent shock loads.

What's more, P&H carefully engineers every crane to meet specific job requirements . . . to consider all factors affecting performance. Special operating problems are taken in stride. Result: P&H cranes chalk up almost unbelievable service records month after month, year after year, decade after decade.

Isn't this the kind of performance you want, too? Write for bulletin C-42 to Dept. 120, Harnischfeger Corporation, Milwaukee 46, Wis.

P&H enclosed cabs have full-view safety glass windows, for unrestricted view of work area. Cabs can be heated and air conditioned where cold, heat, smoke or fumes render ordinary cabs uncomfortable or unsafe.



P&H
OVERHEAD CRANES

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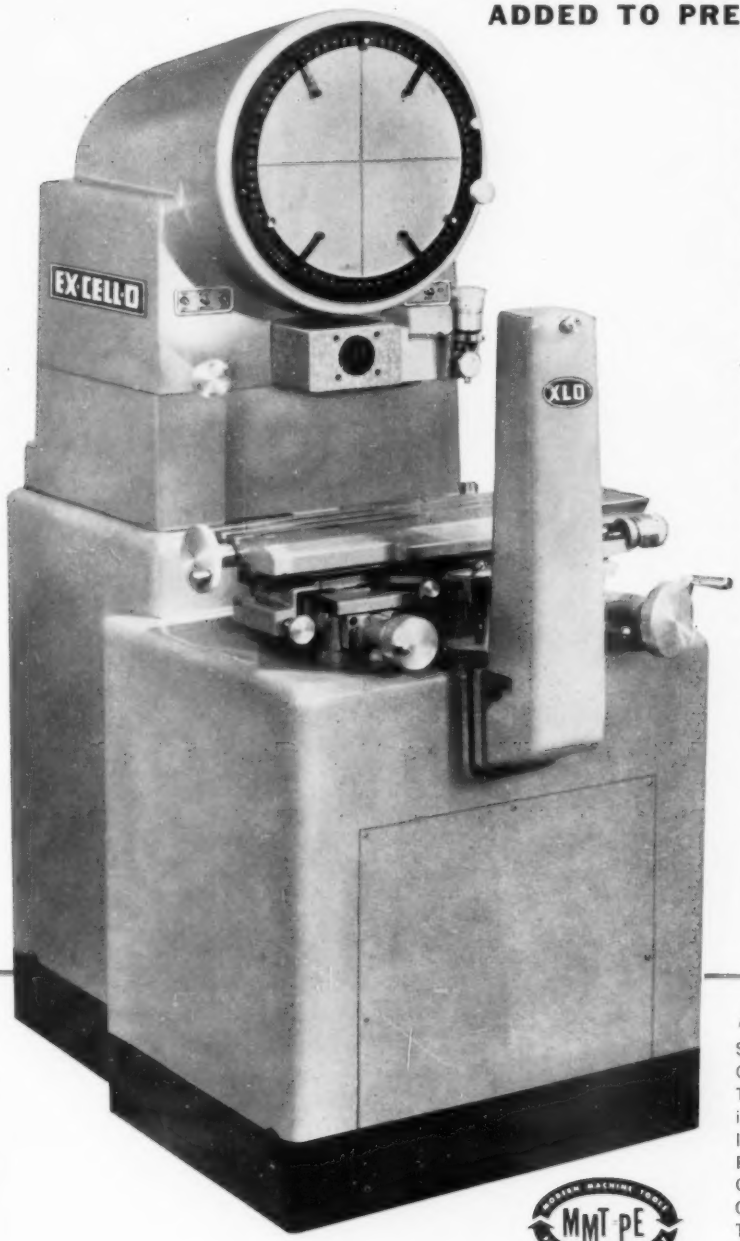
NOW — CONTOUR PROJECTORS FROM EX-CELL-O!

FORMER KODAK® OPTICAL PROJECTORS ADDED TO PRECISION GAGING LINE



Precision Contour Projectors, formerly manufactured by Eastman Kodak Company, have been added to an expanded line of gaging and inspection equipment from Ex-Cell-O. They are sold and serviced by Ex-Cell-O's subsidiary, Optical Gaging Products, Inc.*

Ex-Cell-O Contour Projectors are available in six table and console models for measuring and inspecting parts ranging in size from the smallest watch springs to huge breech blocks, with accuracy to .0001".

Features: Kodak Ektar® highest quality optics; finger-tip controls; vertical or horizontal projection; wide selection of lenses; maximum staging space and table travel; screen sizes from 8" to 30"; and rugged, precision construction.

Model 14-5, heavy-duty Ex-Cell-O Contour Projector, has a 14" screen, built-in helix table, and extra large, heavy-duty work table for fast, accurate inspection of large parts.

®Kodak and Ektar are registered trademarks of Eastman Kodak Co.

*26 Forbes Street, Rochester 11, N. Y.

MMT PE
MODERN MACHINE TOOLS PRODUCTION EFFICIENCY

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See the complete line of Ex-Cell-O, Optical Gaging, Cadillac Gage, Bryant and Michigan Tool Co. precision gaging and inspection instruments: Contour Projectors • Angular Indexing Tables • Height Gages • Ring and Plug Gages • Thread and Groove Gages • Granite Surface Plates • Optical Projector Chart Gages and staging Fixtures • Contour Transcribers • Layout Materials and equipment

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Machinery Division

EX-CELL-O CORPORATION
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60-50

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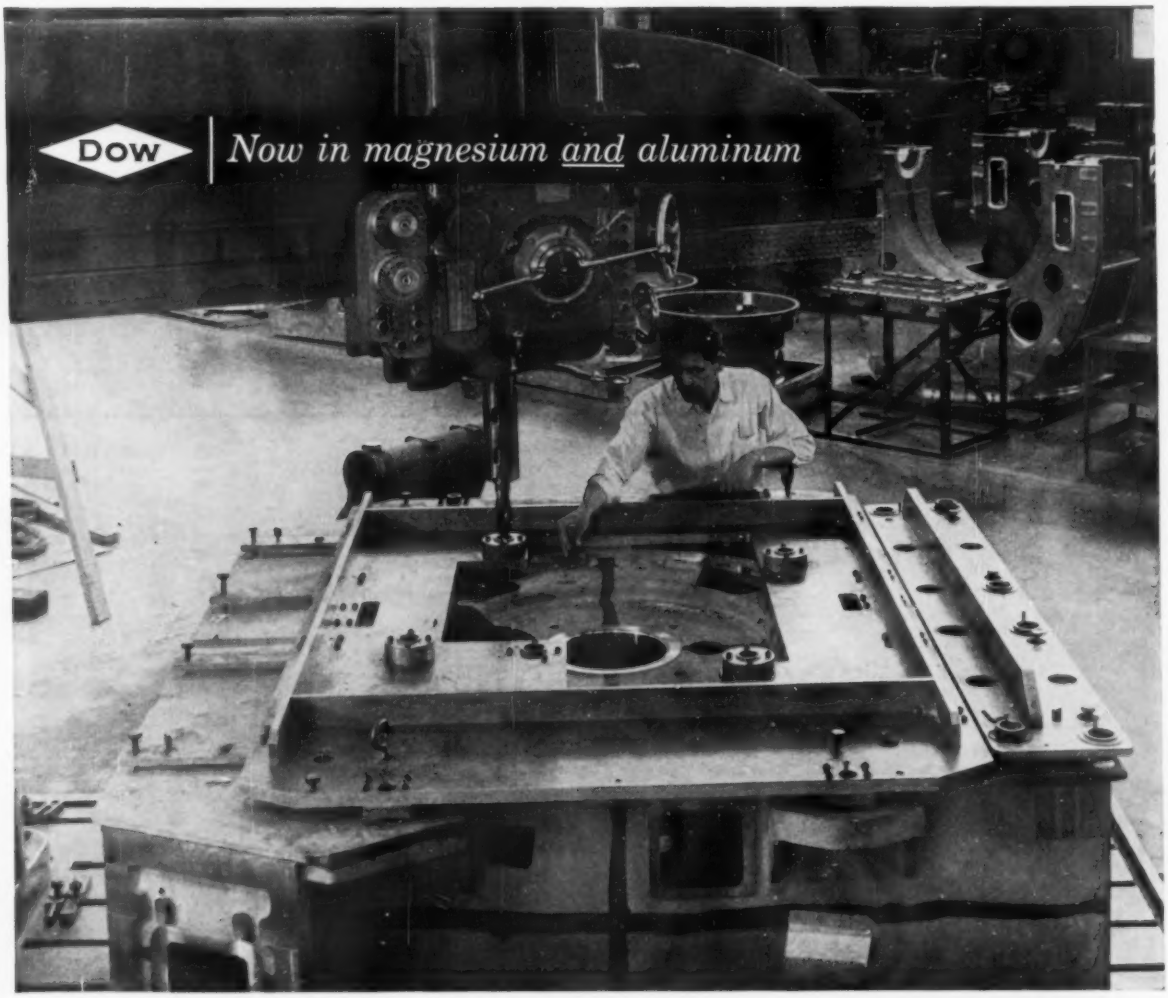


TOTEABLE MAGNESIUM HELPS TOOL HUGE NIKE ANTENNA

"We're using more and more magnesium tooling plate in our shop because it's lightweight, easy to machine and has a superior finish," says the Director of Engineering of Steel Products Engineering Company Division of Kelsey-Hayes.

Light Weight. "We use magnesium tooling plate to make jigs and fixtures of various sizes up to seven feet square in our work on the huge Nike-Hercules antenna," he said. "The largest magnesium tools can be transported with a small lift truck, leaving our overhead crane free for other duties. Many of the magnesium tools can be handled easily by one or two men."

Machinability. "The excellent machinability of magnesium is very important since many operations must be performed to get the two sides of our jigs and fixtures parallel to .001."

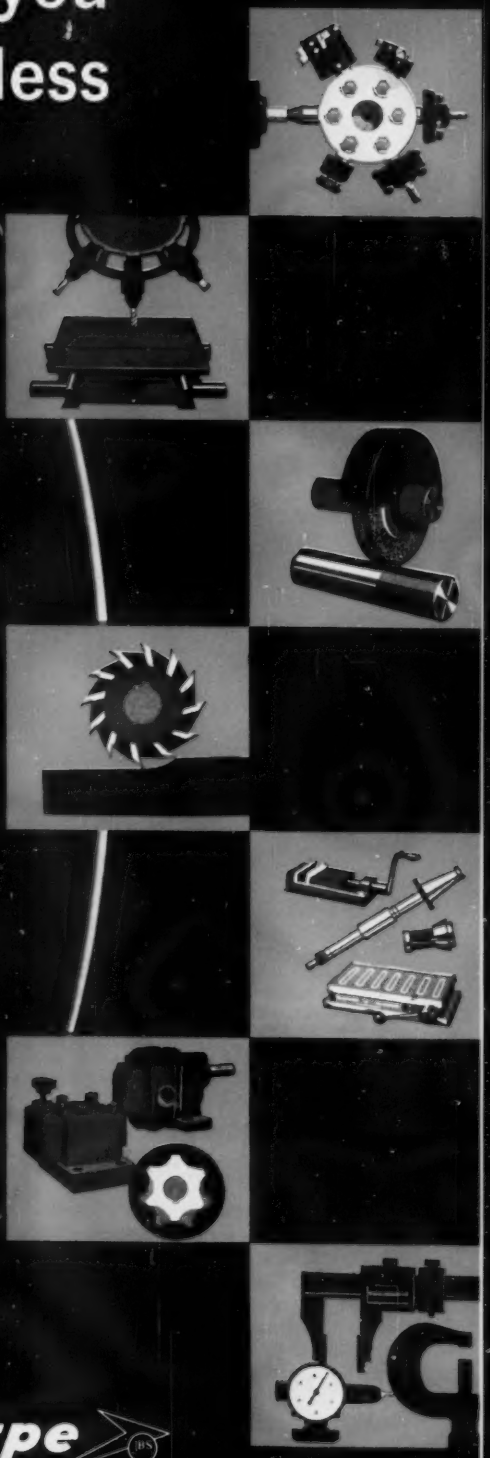
Dimensional Stability. "Magnesium's dimensional stability allows us to hit milling and drilling tolerances on the finished antenna parts of .0002 to .0005."

NEW Magnesium Tooling Plate Manual covers shop working characteristics, properties, design. Contact the Dow sales office near you or write to THE DOW METAL PRODUCTS COMPANY, Midland, Michigan, Merchandising Department 1030FJ4.

DOW **THE DOW METAL PRODUCTS COMPANY**

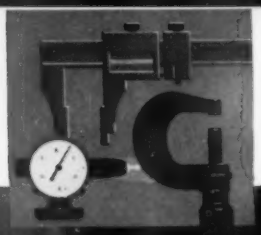
Division of The Dow Chemical Company

to help you
make more for less



Brown & Sharpe

PRECISION CENTER



TO HELP YOU MAKE PRECISION MEASUREMENTS EASIER AND FASTER...

With one simple motion, B&S Dial Snap and Bore Gages slide onto (or into) the work. No adjusting and little "feel" is required, to get accurate ten-thousandth readings with these self-centralizing, spring-loaded tools. They spot exact work conditions, such as bell-mouth, out-of-roundness, etc. And by showing how much work is "under" or "over" — they save "borderline" pieces — aid setting of cutting tools.

B & S Dial Snap and Bore Gages tell you faster ...tell you more...in measuring production parts

For precise measurements of outside dimensions and bore diameters — on a *production* basis — you can't beat Brown & Sharpe Dial Snap and Bore Gages!

They're faster than micrometer or vernier tools for a series of repetitive measurements — more accurate in unskilled hands. And they "tell more" about the work than fixed or comparator gages because they are *direct reading* over a complete *range*.

Four B&S Dial Snap Gages cover a range of 0" to 4" by ten-thousandths. Seven B&S Dial Bore Gages cover a range of ⅛" to 13" by ten-thousandths, with a minimum of interchangeable gaging heads and extensions. Ask your nearby industrial distributor to show you these economical, time-saving tools for precision production measurements. Brown & Sharpe Mfg. Co., Providence 1, Rhode Island.

Be sure to see us at Booth 1131, ASTE Tool Show, Detroit, April 21-28

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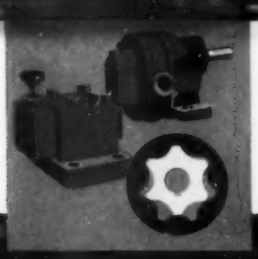
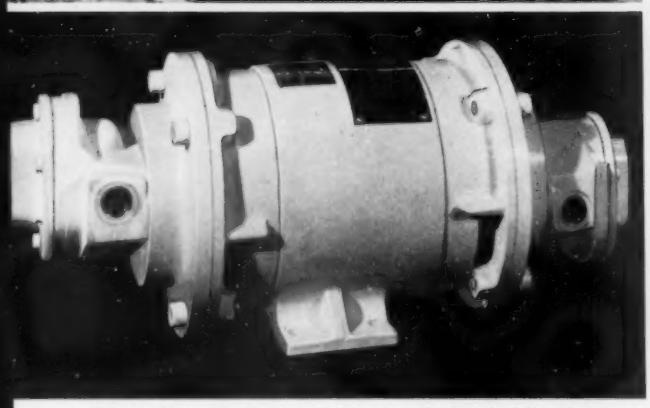
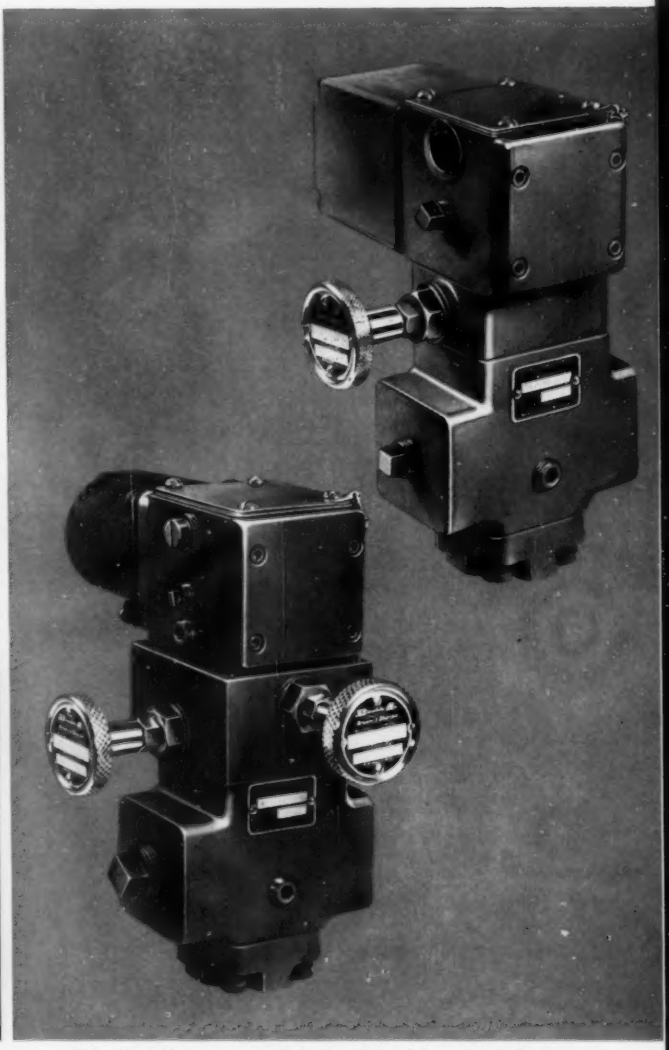


TO HELP YOU HANDLE FLUIDS
MORE EFFICIENTLY...AND FOR LESS



This tracking antenna (above) is an important part of the Air Force Ballistic Missile Early Warning System. Goodyear Aircraft Corp. developed it for R. C. A., prime contractor on the system. B&S pumps replenish oil in drive system; control position of drive pump yoke; lubricate entire system.



Type "J" adjustable pressure relief valve (above) has attached, solenoid-controlled pilot valve — provides automatic, full bypass of fluid at idling pressure. Type "D" dual pressure relief valve with solenoid control (below) — provides automatic choice of two, individually-adjustable maximum pressure settings.

Goodyear designers lubricate BMEWS antenna with B&S Pumps

Designers of this antenna's drive unit needed 4 pairs of pumps, mounted on double-ended motors.

B&S pumps were chosen for their self-priming ability from minus 65°F to plus 160°F; ruggedness and long life.

These and other advantages of Brown & Sharpe gear, vane and centrifugal pumps are clearly described in our new Pump Catalog 36P.

Send for your copy today! Brown & Sharpe Mfg. Co., Providence 1, Rhode Island.

Double A develops first multi-purpose relief valves

Here are two more Double A "firsts" in compact valve units: Adjustable relief valves with *solenoid controls*.

Already successful in machine tools; foundry, steel-mill, mining, material handling and stretch-forming equipment — they can help *you* simplify your hydraulic circuits, too.

For details on these and the complete line of Double A hydraulic control valves, power units, Gerotor pumps — write: Double A Products Co., subsidiary of Brown & Sharpe Mfg. Co., Manchester, Michigan.

Be sure to see us at Booth 1131, ASTE Tool Show, Detroit, April 21-28

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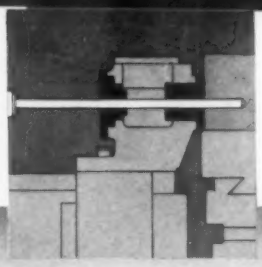
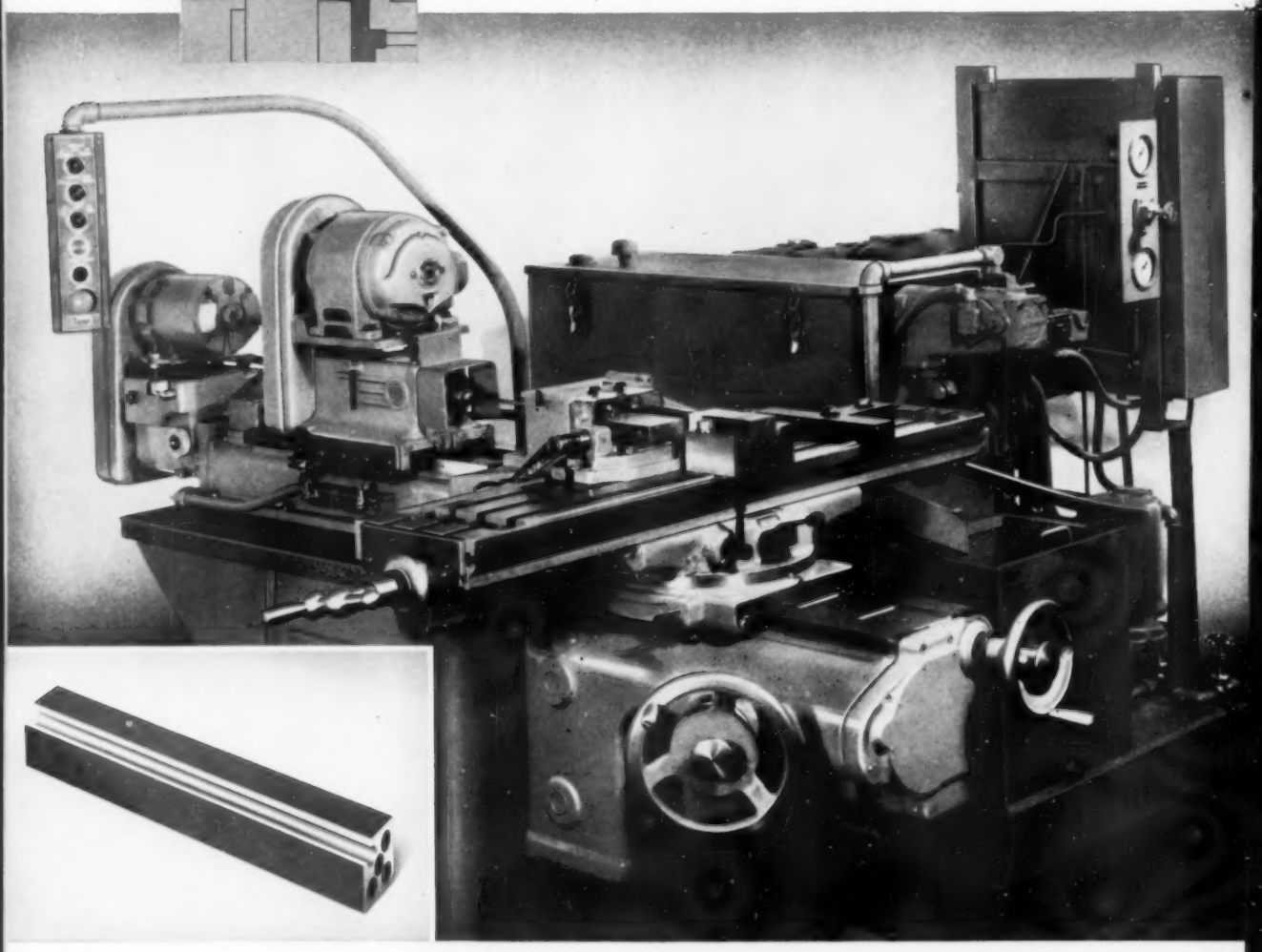
MMT-PE



TO HELP YOU REDUCE
DEEP HOLE DRILLING COSTS



Saves the extra cost of special positioning fixtures - the new Brown & Sharpe Deep Hole Drilling Machine

Simplified set-ups, tooling economy, and exceptional job adaptability are basic advantages of this new, revolving drill type machine, along with many other features unavailable in conventional equipment used for "gun drilling."

The machine itself provides all directional adjustments needed for fast, accurate positioning of the work piece. Standard vises or other simple clamping devices serve to hold the work for most jobs. You avoid the expense of special, complex positioning fixtures for multiple hole location.

The chip box secured to the column of the machine supports the front drill bushing in accurate alignment with the axis of the drill spindle, maintaining hole surface finish in the low micro-inch range. Positioning controls with the same built-in precision as in Brown & Sharpe Milling Machines assure accurate center location and hole alignment.

Drilling-head speeds from 2500 to 10,000 rpm, are available as specified. The machine takes drills from ⅛" to 1" dia., and provides up to 12" feed stroke (24" with optional, extra equipment). The high pressure coolant unit (in background) will provide up to 30 gpm of oil and pressures up to 3000 psi.

Find out how the B&S Deep Hole Drilling machine can be adapted to your needs — with special arrangements, when required, such as optical positioning and tape control. For complete information, write: Machine Tool Division, Brown & Sharpe Mfg. Co., Providence 1, R. I.

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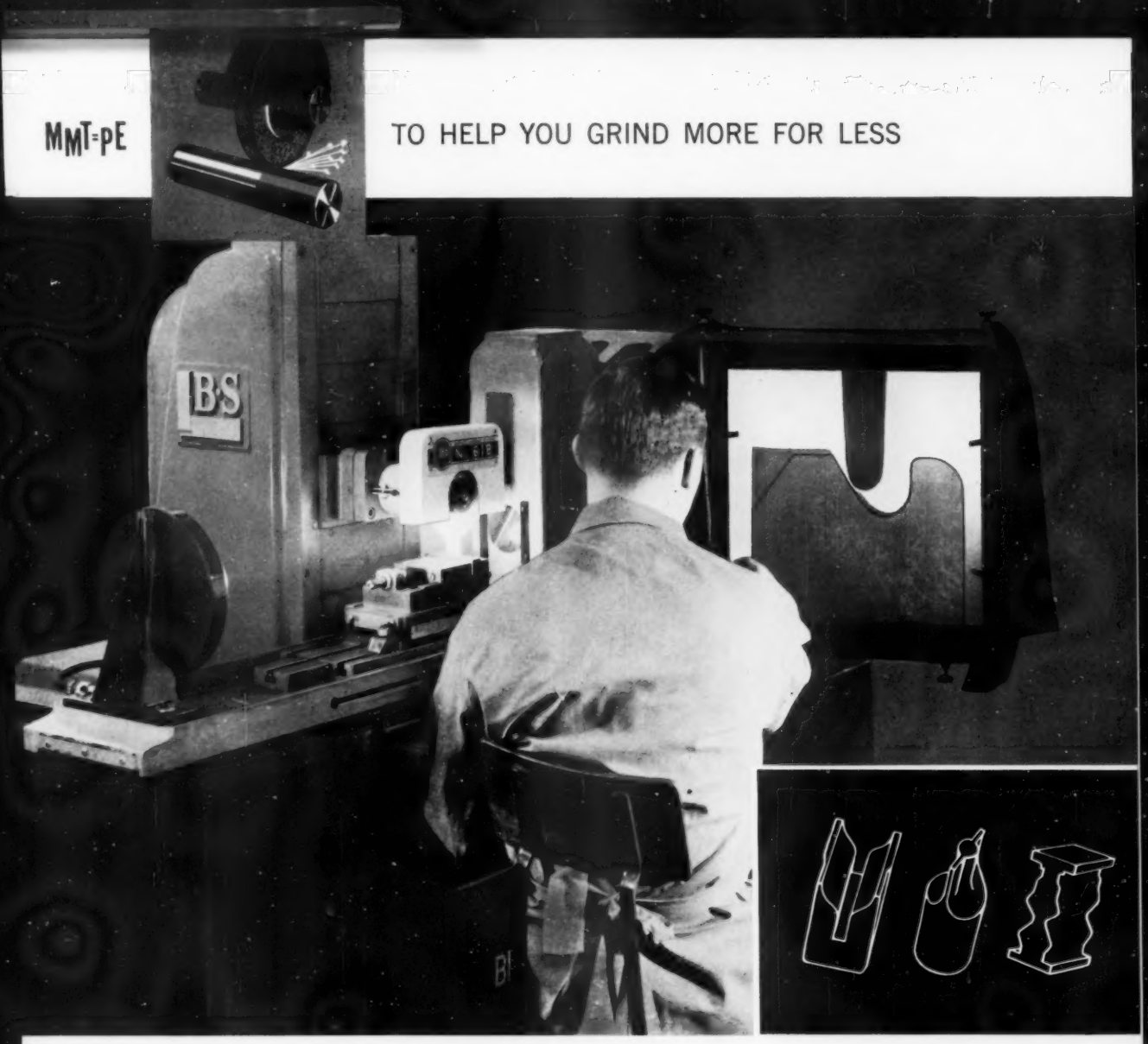
MMT=PE

TO HELP YOU GRIND MORE FOR LESS



Up to 300% faster form grinding in carbide, ceramics – Brown & Sharpe MICROMASTER with VISUAL GRIND

VISUAL GRIND, the built-in comparator on the B&S 618 Surface Grinding Machine, permits tool and die makers to meet today's demand for intricate shapes in super-hard materials with spectacular savings in work hours and wheel costs.

Skilled operators can save up to 300% in set-up and grinding time. There is no need to remove work for frequent inspection with separate equipment. Semi-skilled workers, also, quickly learn to "follow the line," and match the clearly visible, true image of the work to the form layout drawn on the screen. Wheel costs are drastically reduced in grinding carbide and ceramics — any contours can be reproduced with a few simple wheels.

An unlimited variety of forms can be produced in punches, dies, and similar work — with through, blind, or template grinding — using standard equipment and simple attachments.

The MICROMASTER® with Visual Grind provides all the extra profit-saving advantages of the new B&S 618 Surface Grinder. It can be readily used for other grinding, of surfaces up to 6" x 14", without disturbing the optical system.

THE VISUAL GRIND® system is manufactured by The Cleveland Grinding Machine Co. and is sold only by Brown & Sharpe. For details, write: Machine Tool Division, Brown & Sharpe Mfg. Co., Providence 1, R. I.

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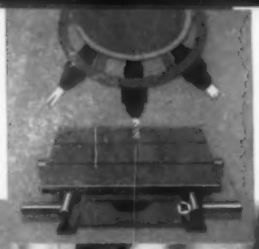
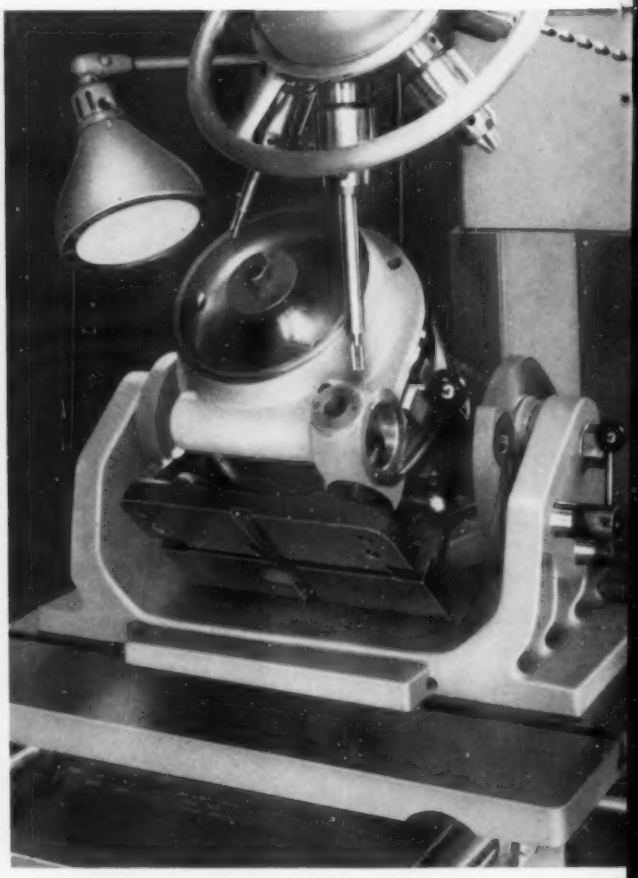
MMT-PE



TURRET DRILLING MACHINES
TO HELP YOU DRILL MORE FOR LESS



Large parts machined 300% faster with simple tooling on Brown & Sharpe Turret Drilling Machines

For large as well as small parts, the B&S Turret Drilling technique drastically reduces production drilling costs.

The typical machine casting shown requires machining of 23 holes spaced from ½" to 12" apart — drilling, tapping, and counterboring in 4 planes. With simple B&S designed fixtures, mounted on a 10½" x 12" B&S Positioning Table, accurate hole location (within .001") takes only a few seconds in each sequence. Production time is one-third that required for conventional drilling.

Rapid, accurate positioning methods can be similarly adapted for big savings in production drilling of your larger pieces. On the Model A Turret Drilling Machine shown, you can machine any hole pattern within a 24" circle.

Brown & Sharpe Turret Drilling can save up to 80% of your costs for conventional gang-drill, box jig methods. It permits multiple operations at a single station — accurate duplication of any hole pattern without expensive jigs. You save in work transfer and set-up time, in tool wear and maintenance, in capital investment and floor space.

The BROWN & SHARPE Tooling Clinic designed the fixtures shown above to take full advantage of turret drilling economy. The work is held as shown (left) in a simple clamping fixture for the first sequence, 24 operations in 8 holes. It is then turned over in the same fixture for 23 operations in 8 holes. The trunnion with index head (right) orients the work for the final sequence, 20 operations in 7 holes, in 3 planes. Send your parts and drawings for a free estimate of savings with turret drilling. Write: Turret Drilling Division, Brown & Sharpe Mfg. Co., Providence, Rhode Island.

Brown & Sharpe PRECISION CENTER

Use Reader Service Card, CIRCLE 38

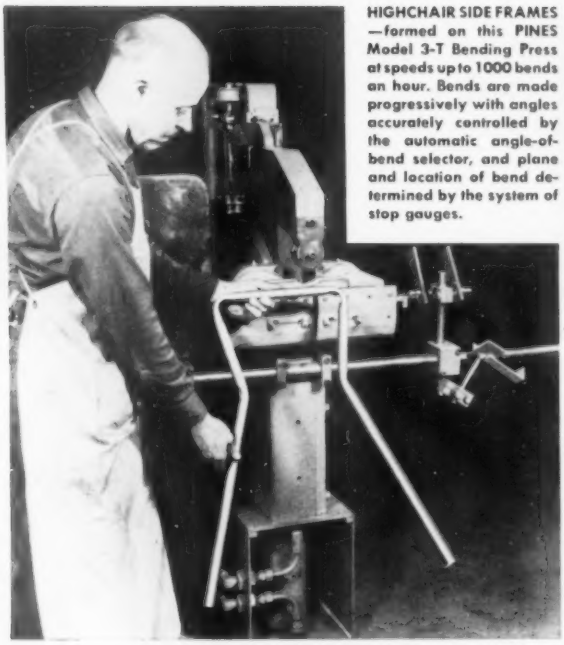
Whitnon precision cluster spindles for improved accuracy at lower cost

Whitnon multiple-shaft boring spindles give close and unvarying tolerances essential in mass-producing such parts as transmission housings, pump bodies, and gyro gimbal frames. Rough boring, high-finish boring, counterboring and spot facing operations can all be combined in one by the use of precision cluster spindles, and a workpiece moving between two cluster spindles can be multi-processed on both sides, in perfect register, with only one set-up. Shaft centers in Whitnon cluster spindles can be placed very close together without sacrificing rigidity and ruggedness, by offsetting the pulleys and bearing assemblies. Full assistance and information without obligation.

Specialists in the design and manufacture of high-precision spindles for boring, milling, grinding and drilling. Custom builders of precision rotary machinery. Expert repairs for all anti-friction spindles in Farmington and at The Whitnon Spindle Company, 20466 Wyoming Ave., Detroit 21, Mich.

Whitnon

The Whitnon Manufacturing Company,
Route 6 and New Britain Ave., Farmington, Conn.



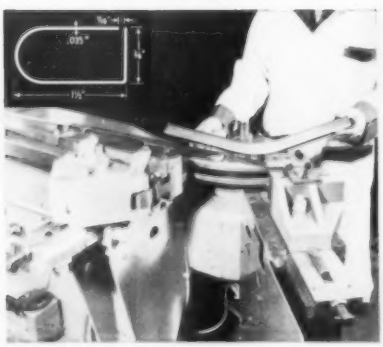
HIGHCHAIR SIDE FRAMES—formed on this PINES Model 3-T Bending Press at speeds up to 1000 bends an hour. Bends are made progressively with angles accurately controlled by the automatic angle-of-bend selector, and plane and location of bend determined by the system of stop gauges.

A DIFFICULT ALUMINUM EXTRUSION BEND—Preventing distortion and warping was difficult in making this 90° bend in 6063-T6 aluminum on a 9⅜" inside radius. A split-type bending die and link mandrel, on a Model 2 machine, produced wrinkle-free bends with no distortion.

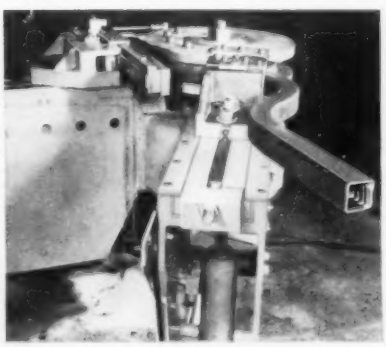
COLD BENDING
THE PINES WAY
Can Help You Remain Competitive

• High-quality bends at high speed is the key to a favorable competitive position in the fabrication of extrusions, tubing, pipe, or rolled sections. And the PINES WAY of bending is the key to quality and speed. It includes superior design, tooling to suit the job, provisions for quick setup, and competent service.

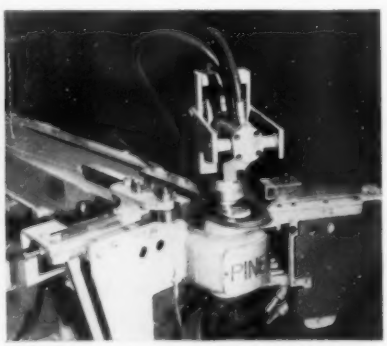
Some examples of the results of these factors are illustrated here. Whatever your metal-forming needs may be, it will pay you to investigate bending the PINES WAY. For assistance on your jobs or a cost analysis, call on Pines without obligation.



D-SHAPED STEEL CHANNEL—Unique tooling permits edge-bending without closing the ⅛" slot. 37° bends are made on a 9" inside radius to form side rails for playground slides. Done on a Model 1¼ Bender.



SQUARE-TUBE VEHICLE FRAMES—Bending of SAE 4140 steel tubing, 3" square x .239" wall on 10½" radius is done on this Model 4 Bender. Tooling illustrates use of compound die for clamping on bent section.



FLAT STEEL BARS—Three ⅜" x 1" bars are bent in one operation to 160° on this Model 1 Bender. A split die actuator opens the dies for easy removal of the pieces. Bends are smooth and wrinkle-free.

PINES ENGINEERING CO., INC.

Specialists in Tube Fabricating Machinery

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10 to 100 Times FASTER!

7 SIZES FOR EVERY JOB REQUIREMENT

Model	Tub Capacity	Tub Size, Inside		
		Length	Width	Height
VT-70	¾ gallon	7″	4¾″	6″
VT-71	1 cu. ft.	12″	12″	12″
VT-72	2½ cu. ft.	15″	16″	18½″
VT-75	5 cu. ft.	31″	17″	19½″
VT-77	7 cu. ft.	31″	17″	22½″
VT-712	12 cu. ft.	35″	25″	30⅜″
VT-717	17 cu. ft.	47″	25″	30⅜″

New VT-72 Vibrasheen being unloaded into optional hoist-pan. Note convenient height of controls.

ANOTHER REPORT FROM THE ALMCO ALBUM OF NEW PRODUCTS

IT'S A FACT! With the seven (7) new ALMCO Vibratory Machines, you can expect finishing time cycles 10 to 100 times faster than with standard horizontal barrel finishing equipment. It's a significant production break-through, made possible by creating constant vibratory motion to activate the entire mass of media and parts in the finishing container, as compared to only 20% activation with conventional barrel finishing methods.

The uniform vibratory motion of the media in recessed areas, blind holes and small I.D. dimensions make it possible to obtain optimum results on a multitude of applicable parts with intricate configurations that can not be completely processed in standard horizontal barrel machines.

What's more, this amazing metal finishing machine only requires 50% of the floor space that is taken up by any other machine of this type with a similar capacity. Time and motion is at the absolute minimum with all convenient operating conditions.

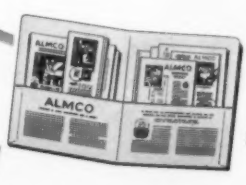
Tub features. Holds a 2½ cu. ft. load of parts and media. Equipped with vibrating mechanism adjustable for impact range of from 600 to 2550 lbs.; has a vibration frequency of 3380 rpm with variable drive optional. Pivots through 180° arc. Lined with tough ⅜″ plastisol. Quick-acting cam-lock drain door facilitates flushing of tub.

Investigate today, the ALMCO *Vibra-Sheen way!*

FREE

NEWS ABOUT ALMCO'S NEW PRODUCTS

New Almco Album describes the latest in metal finishing machines, methods and media. Write today for free copy!



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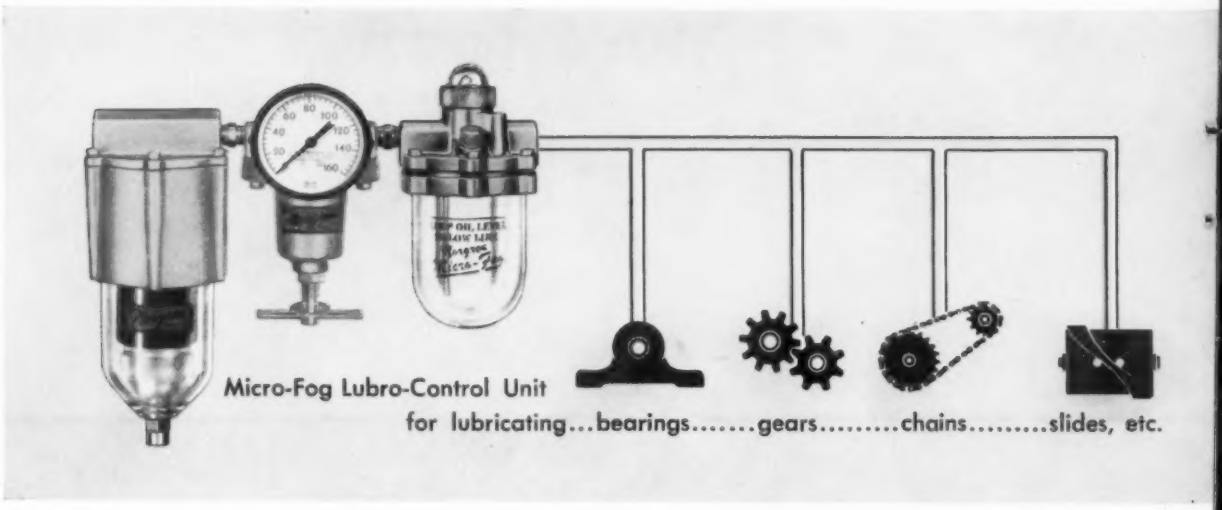


Norgren
MICRO-FOG LUBRICATION

Automatically lubricates every bearing surface on a machine

About 10 years ago, a new type of oil fog lubrication, called Micro-Fog was marketed by the C. A. Norgren Co. More and more machine tools are being completely lubricated with Micro-Fog—all bearings, gears, chains, slides, ways.

With any method of lubrication, the only oil that actually lubricates is the thin film that separates the bearing surfaces. Any additional lubricant is a waste and may even be harmful, causing overheating through fluid friction.

An air-borne fog of extremely small oil particles is created by a Norgren Micro-Fog Unit. This Norgren Micro-Fog can be conveyed long distances through low pressure pipelines directly to the bearing surfaces.

Micro-Fog provides thorough lubrication

At the bearing surfaces a nozzle-like fitting, called a reclassifier, causes the small dry oil particles to combine into larger wet particles. These impinge upon the bearing surfaces and cover them thoroughly and continuously with a protective film of oil.

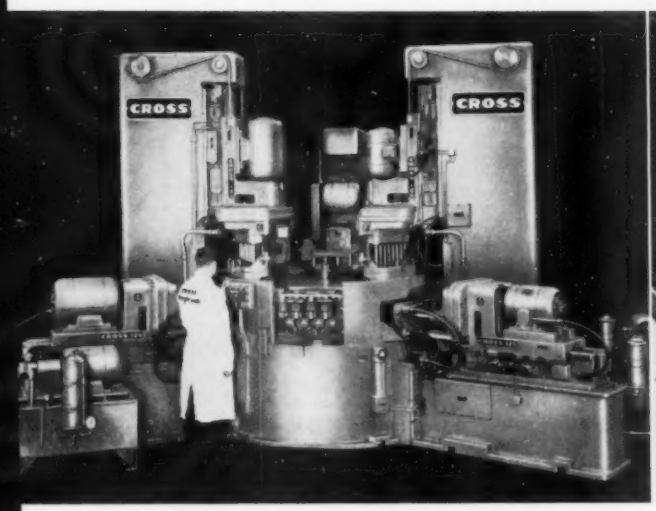
A Norgren Micro-Fog Lubro-Control Unit is a combination of three Norgren Units – an air line filter to remove the compressed air contaminants, a pressure regulator to accurately control pressure and a Micro-Fog Lubricator.

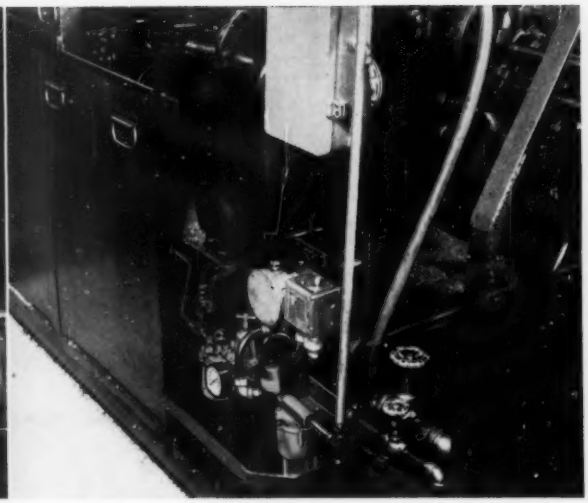
Norgren Lubro-Control Units are adjustable to deliver automatically just the right amount of Micro-Fog to provide continuous lubrication.

A few of the benefits provided by Micro-Fog:

Longer bearing life. Reduced downtime, maintenance and bearing replacement costs. Lower bearing temperatures. Less lubricant used—lower lubricant costs. Centralized lubrication, eliminating time-consuming hit and miss methods. No excess of lubricant—minimum product contamination and easier housekeeping.

Today, Micro-Fog Lubro-Control Units are operating successfully on practically all types of equipment. These applications range from high-speed precision grinders, running at 450,000 rpm, to huge rolling mill bearings on shafts as large as 34″ in diameter and turning at relatively slow speeds.



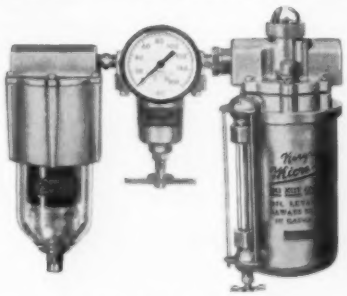


The 150 ball bearings and 70 spur gears on this machine are lubricated by a single Norgren Micro-Fog Lubro-Control Unit. Results: 1. Bearing and gear box seals eliminated. 2. Oil leakage of lubrication system eliminated and safer floor conditions around machine. 3. Oil usage greatly reduced.

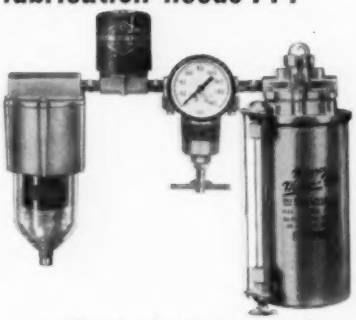
With Norgren Micro-Fog, ½ pint of oil per day does a better job of lubrication than the 15 gallons of oil used per day with the previous circulating system. On this automatic screw machine, the Norgren Micro-Fog Unit lubricates sleeve bearings, anti-friction bearings, slide blocks, guides, chucking mechanism and gears.

Wide selection of Norgren Units meets most machine lubrication needs . . .

Small, compact units for use where space is tight.



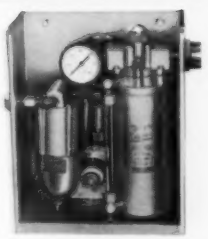
A Norgren Lubro-Control Unit can be made up of any combination of Norgren filter, regulator, lubricator.



A solenoid valve for starting and stopping lubrication as machine is turned on and off can be incorporated as part of a Lubro-Control Unit.

This Lubro-Control Unit is small, compact and complete with filter, regulator and lubricator. It measures only 6 1/32" x 6 1/32" x 5 3/16".

Compact and complete, this Norgren Unit includes automatic alarm controls that safeguard the machine against lubrication failure.



This cabinet unit can be entirely enclosed and locked. It is compact and complete and is equipped with automatic alarm controls.

The above is only a partial listing of the complete Norgren line. For complete information on the large selection of Norgren Micro-Fog Lubro-Control Units available, ***WRITE FOR DESCRIPTIVE LITERATURE***

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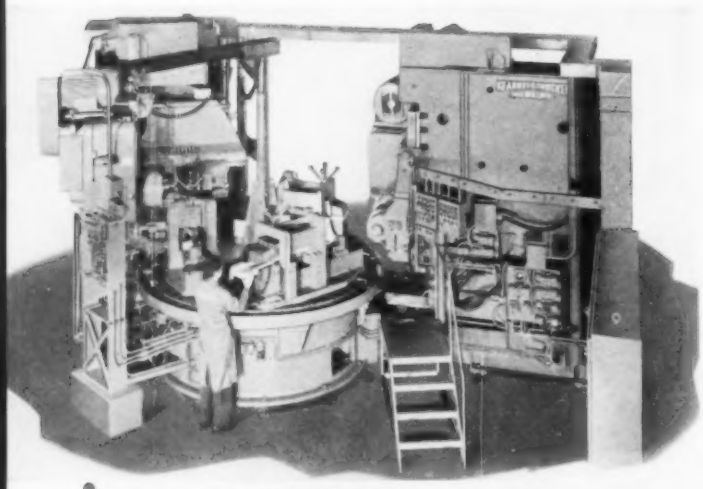
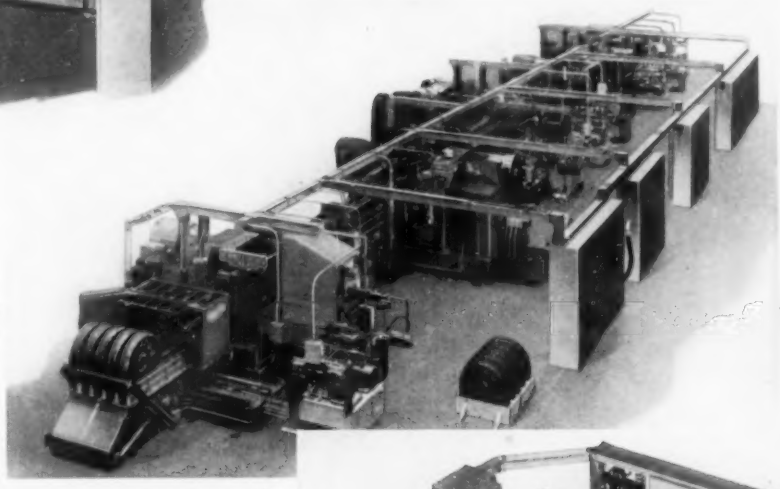
For the Whole Story

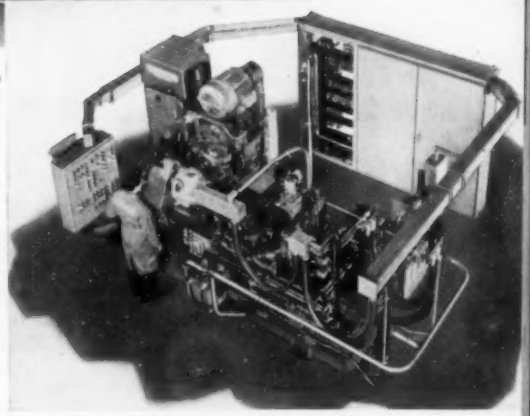
. . . ask your local Kearney & Trecker representative for Bulletin SMD-57 . . . 16 pages packed with *"Performance-Proved"* examples of how K & T Custom Engineering has paid off for manufacturers in every industry.



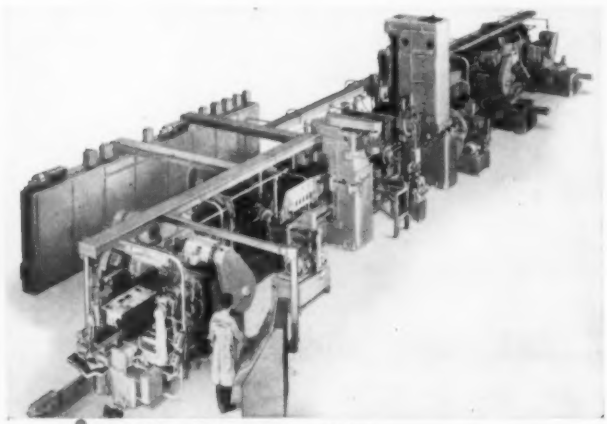
STEAM TURBINE INDUSTRY
3 station rotary index machine mills root ends on large turbine buckets.



RAILWAY EQUIPMENT INDUSTRY
30 station railroad car wheel boring, facing, and turning machine.



AIR CONDITIONING INDUSTRY
Mills cylinder pads and feet on a variety of compressor housings.



DIESEL ENGINE INDUSTRY
15 stations — 31 milling, drilling, reaming operations on 6, 8, 12-cylinder, V-type engine blocks.

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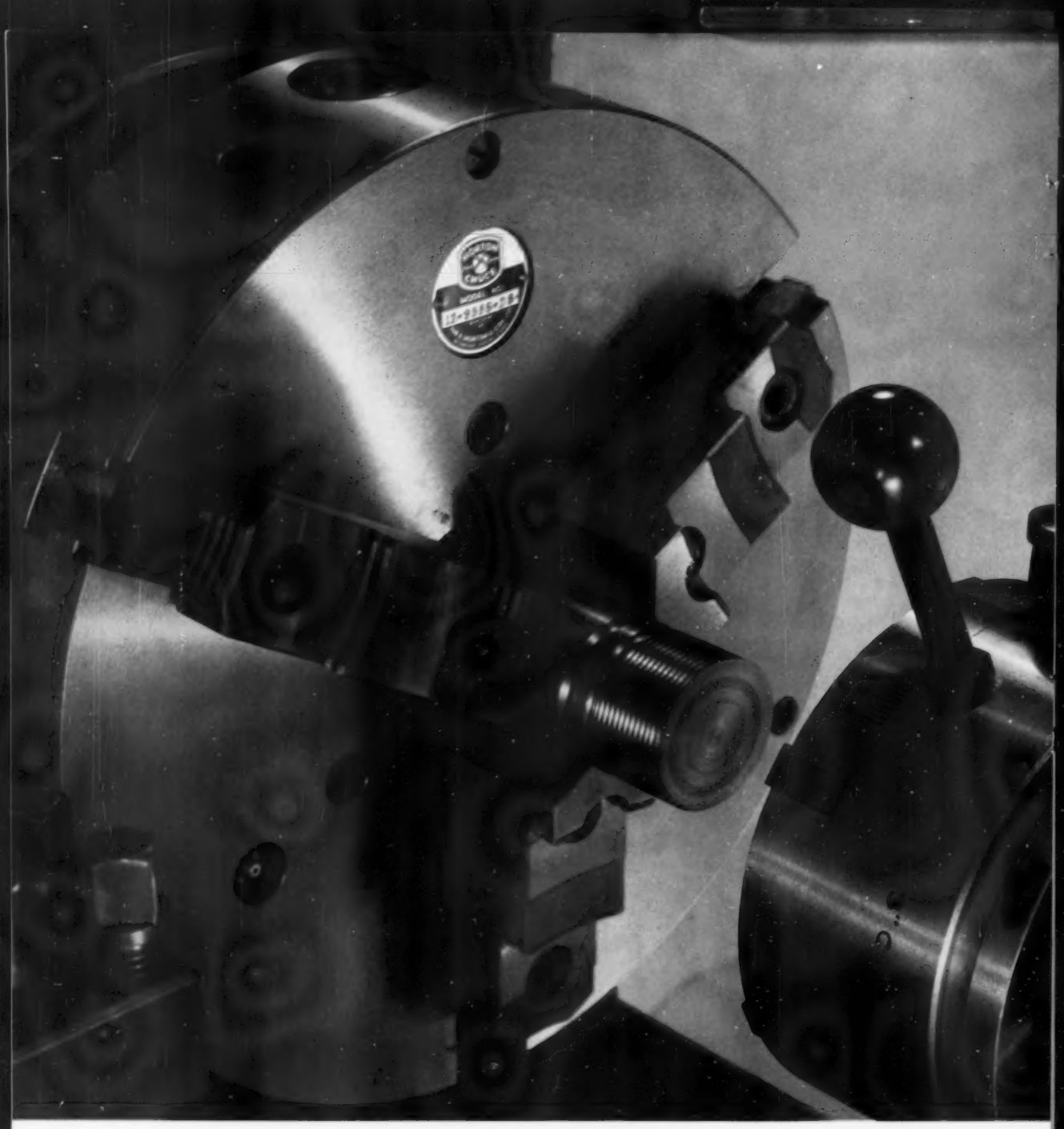
WINNERS ON POINTS

Every material has machining characteristics
which call for a little different drill point for best results.

For ordinary free machining steels standard 118° points are entirely satisfactory. Plastics machine best with a sharper angle, usually 90°. That tough, work hardening stainless steel requires a flatter (135°) split point to do a real job on it.

Whatever the material you are drilling, there is a best drill. May we send a GREENFIELD-AMPCO drill expert to discuss other points of interest to you?

GREENFIELD TAP & DIE
GREENFIELD, MASSACHUSETTS



CLASS 3 THREADS WITH HORTON CHUCK!

What do we mean, talking about chucks and class 3 threads in the same breath? Just this: unless the work is held concentrically and runs true, that die head which is the best there is for the job (Geometric, of course) cannot compensate for excessive "run out" in the chuck.

That's why you need precision chucks, for precision threading.

Running class three threads? Better check your chucks, "Chuck" out worn out chucks, and, replace them with new HORTONS.

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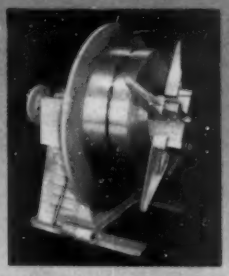
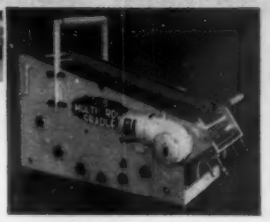
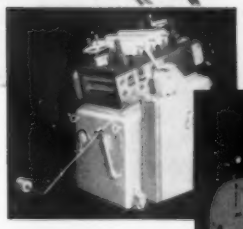
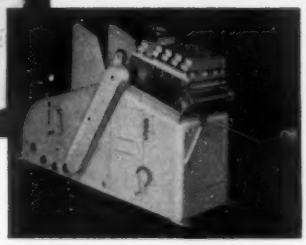








When the familiar orange and black U. S. Tool Proposal reaches your desk you are on the road to Punch Press Production that will please the most pessimistic.

There is no "high pressure" in a U. S. Proposal. Each one details our method of handling the material for the particular metal stamping project involved. You get the facts . . . you get the figures.

To insure positive Punch Press feeding, major press manufacturers often specify U. S. Feeds and U. S. Stock Straighteners as original equipment. They do so because they know that **Profitable** Punch Press Production depends upon the utmost efficiency, from coil stock to finished stamping.

Consider your present equipment — is it really set-up for **Profitable** Punch Press Production? If not, let us submit our PROPOSAL to help you achieve greater efficiency and economy in your stamping operations.

Send for Bulletins No. 85T and 151T.

Illustrated here are (reading from top to bottom): ACR-1642 U. S. Automatic Centralizing Reel; ACC-1648 U. S. Automatic Coil Cradle; SF-68A U. S. Slide Feed with Plain Straightener; PDS-16H U. S. Power Driven Straightener; PDSC-1648 U. S. Combination Cradle-Straightener.

U. S. TOOL COMPANY, INC.

VISIT OUR BOOTH '60 ASTE TOOL SHOW

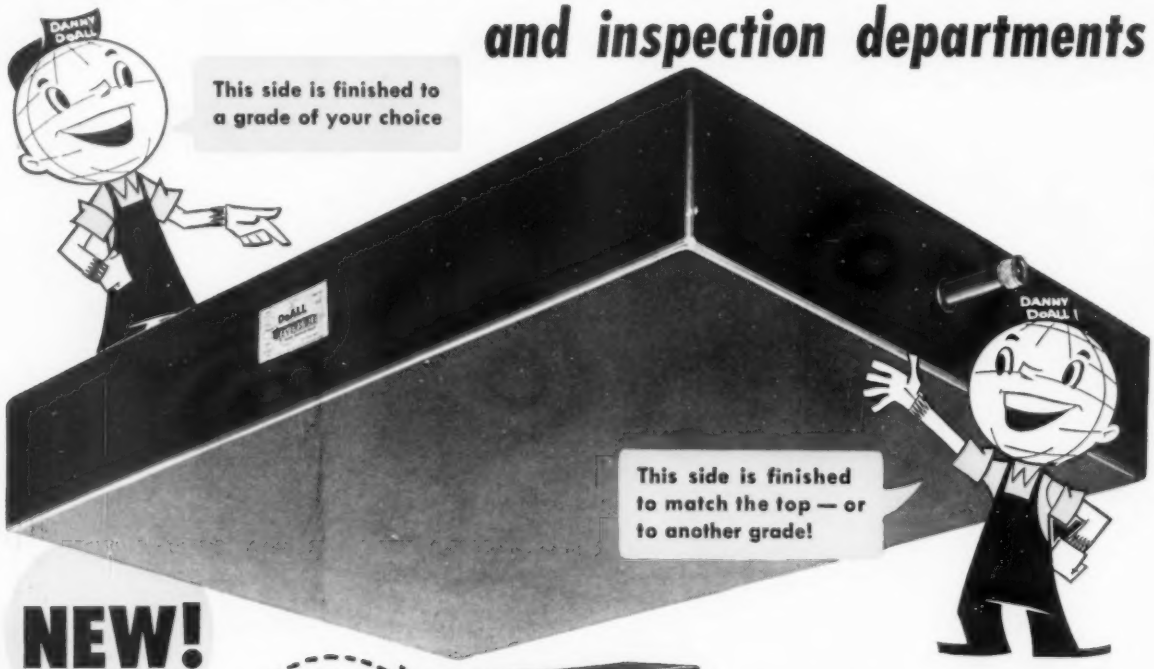
BOOTH 1520

U S PRODUCTS

U. S. TOOL COMPANY, INC.

AMPERE (East Orange) N. J.

DoALL Announces . . . great news for setup and inspection departments


DANNY DoALL
This side is finished to a grade of your choice
DANNY DoALL !
This side is finished to match the top — or to another grade!

NEW!

Double **REVERSIBLE** Faced

BLACK GRANITE SURFACE PLATES

DoALL reversible surface plates are easily turned by standard bolts screwed into threaded inserts permanently imbedded in two sides. Fixture or work that must be held rigid is easily secured to the plate by a "C" clamp at any point along the periphery.

Here's a money-saving, time-saving, space-saving "first"—black granite surface plates finished on both faces. They're easily reversed by using inexpensive removable trunnions.

There's double usefulness in these new DoALL reversible surface plates. For example, one side can be used as a working surface while the reverse side is reserved for master inspection. Both sides can be lapped to the same grade or to any combination of standard grades—AA (laboratory), A (inspection) or B (shop). And you always have an extra plate that takes no extra space in reserve for emergencies.

DoALL reversible surface plates cost only one-third more than single-faced plates. This slight extra cost is more than offset by savings in freight charges, down time and the expense of having a plate reconditioned.

DoALL reversible plates are made from the same high-quality granite used for all other DoALL black granite products. They are extremely rigid, glare-free and harder than tool steel. There's no better granite for this purpose—anywhere.

Call your local DoALL Sales Engineer. He will gladly advise you on your black granite surface plates and accessory requirements.

See the DoALL Exhibit in Booth 1226, ASTE Tool Show

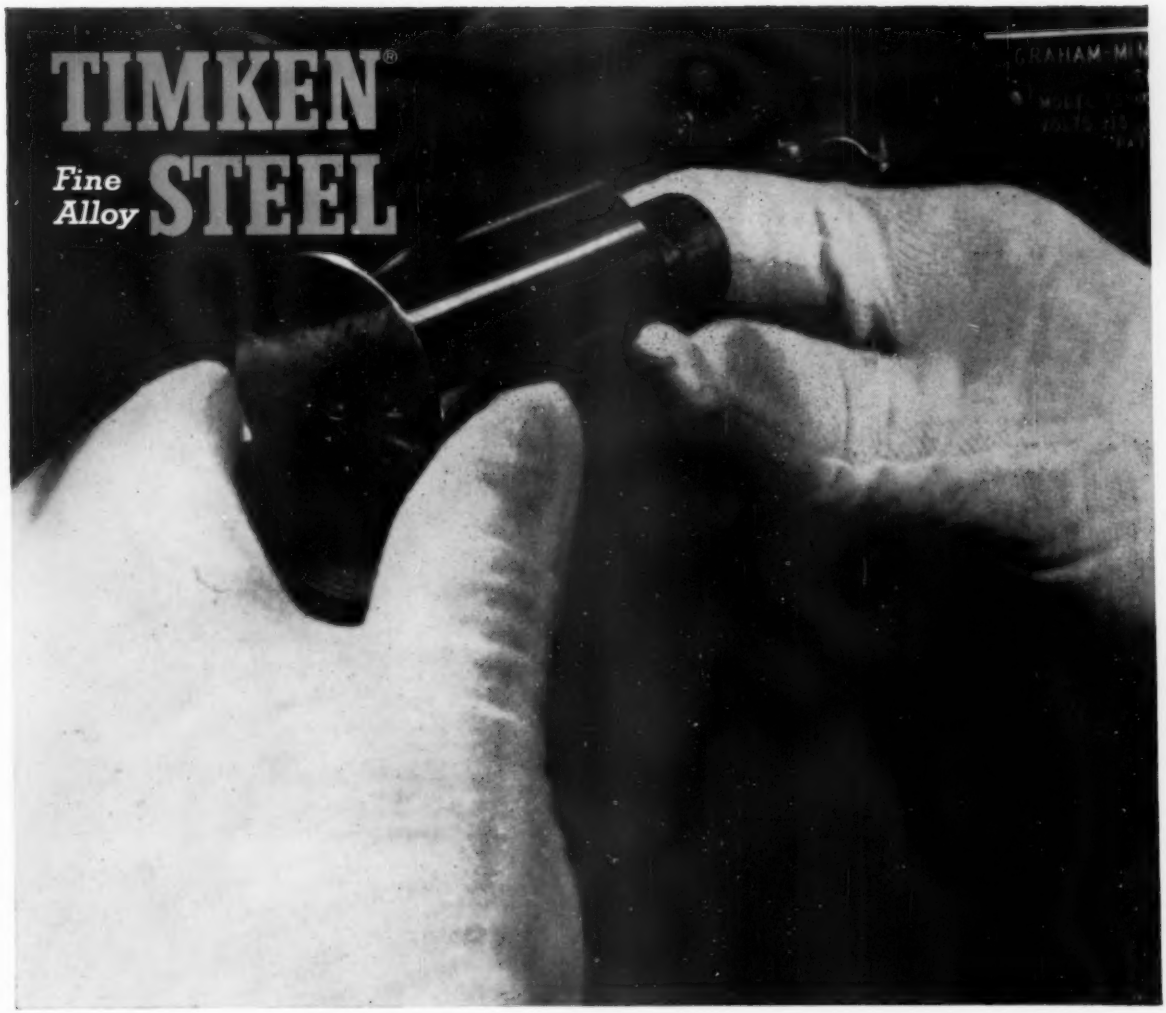
BG-5

Find Your DoALL STORE In The "Yellow Pages"

The DoALL Company, Des Plaines, Illinois

This is a typical DoALL Store

Call Your DoALL Sales-Service Store



Why GRAPH-MO® steel makes better gages and dies, cuts cost, too

The master plug gage in the illustration above showed less than 10 millionths of an inch change after twelve years of use. It's made of Graph-Mo®, one of the family of Timken tool steels—the most stable steels you can buy.

In addition to its great stability, Graph-Mo wears longer. As a matter of fact, users report it outwears other ordinary steels 3 to 1. This is because of the combination of free graphite particles and diamond hard carbides in its structure.

And you save money with Graph-Mo. A special oil-hardening tool steel, it machines faster and easier than ordinary steels. As a result, machining time and production costs are reduced.

When you buy Timken steel you get... *1) Quality that's uniform from heat to heat, bar to bar, order to order. 2) Service from the experts in specialty steels. 3) Over 40 years experience in solving tough steel problems.*

All these advantages are yours at no extra cost. Graph-Mo costs no more than other oil hardening tool steels. And remember, there is only one Graph-Mo. The Timken Company makes it.

The Timken Roller Bearing Company, Steel and Tube Division, Canton 6, Ohio. Cable: "TIMROSCO". *Makers of Tapered Roller Bearings, Fine Alloy Steel and Removable Rock Bits.*

See us at the Atomic Exposition, New York Coliseum, April 4-7, Booth 228

TIMKEN GRAPHITIC STEELS ARE CARRIED IN STOCK BY 9 DISTRIBUTORS WITH 47 WAREHOUSES IN 39 CITIES IN THE UNITED STATES AND CANADA

SUNDSTRAND "Engineered Production" METHODS...

practical ideas for men who are responsible for manufacturing quality, quantity, and profit

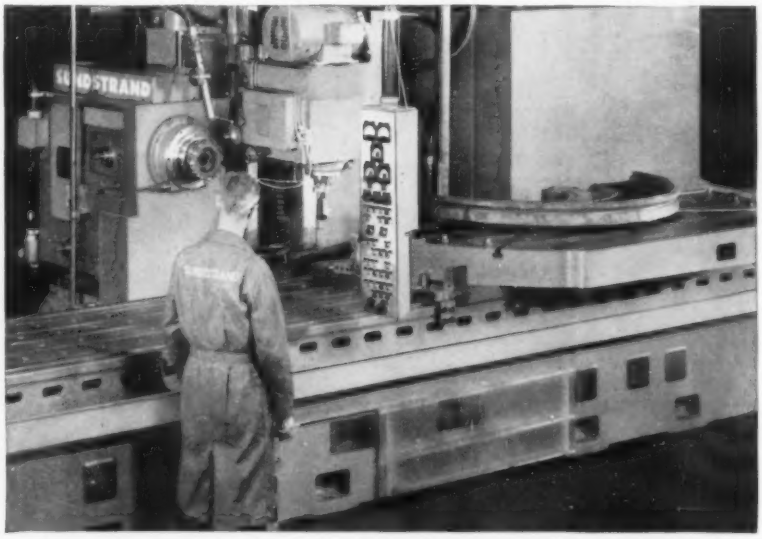
MILLING

— Sundstrand Rigidmil combines two operations, returns 25% of its cost annually

Turbine diaphragms formerly produced by a method requiring three machines now are turned out faster and better on a single Sundstrand Rigidmil with a vertical and a horizontal spindle. Two operations are required — machining of flat surfaces where the diaphragm halves are joined, and milling of special keyways, the latter performed by the vertical spindle of the Rigidmil.

The Sundstrand machine will return more than one-fourth of its cost annually by savings in direct labor, setup time, reworking, and hand finishing. Additionally, it releases floor space, will meet new demands for larger workpieces, and will permit better tool control. On some diaphragms, the new equipment will save four setups and 26 crane lifts.

Selection of the machine was based on the proved performance of similar Sundstrand machines in the field,



and on the fact that it could be built specifically for the job almost entirely from basic standard elements.

Wherever you have operations that might be performed or combined on a milling machine, a Sundstrand "Engineered Production" Analysis will help you establish the economic feasibility of a new machine. For more details on Sundstrand Rigidmils, ask for Bulletin M-714.

MULTIPLE-SPINDLE DRILLING

— new Sundstrand machine features low-cost precision heads which can be changed over in 15 to 20 minutes

Sundstrand multiple-spindle precision drilling, boring, reaming, and tapping machines embody a new concept which provides exceptional versatility and economy, particularly on nonferrous parts. The unique design of the heads eliminates all gearing and permits a complete change-over from one head to another in 15 to 20 minutes.

The moderate cost of the heads and the relatively low-cost spindles which can be used make the machines practical even for moderate production runs of a variety of parts. And, often a single head can be designed for machining two or more similar parts. In the event of a change-over in work handled, up to 75% of an obsolete head can be salvaged to make up a new one.

There is no sacrifice in precision. Tolerances to .0002" for spatial relationship, shoulder depth, and hole size can be maintained by operators with ordinary skills — depending on size of part, shrinkage, expansion, material composition, tool maintenance, etc. Inspection requirements are greatly reduced because spatial accuracy is built into the head, fixtures, and machine itself.

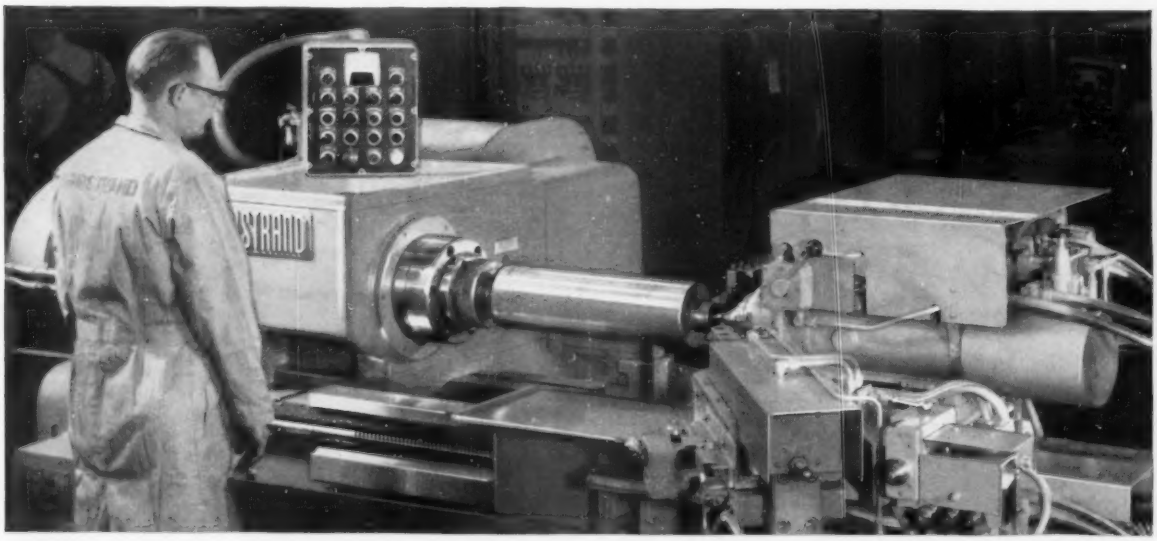
Even change-overs take no special operator skills because the head mates with the machine spindle with foolproof simplicity. The workholding fixture is positioned quickly and simply in relation to the workhead.

For complete information, ask for Bulletin No. D-714.

TRACER TURNING

— Sundstrand machine turns and faces parts in one-third the time of former method

This Sundstrand multi-cycle tracer lathe turns the outside diameter and faces shoulders of air compressor rotors three times as fast as equipment previously used. Ten different parts are produced in lot sizes averaging 20 pieces. Whether for short or long runs, you can expect comparable economies when you replace obsolete turning equipment and methods with modern Sundstrand automatic lathes. A Sundstrand "Engineered Production" Analysis will determine the machine and tooling that will provide you lowest possible manufacturing cost. For more details on Sundstrand Lathes ask for Bulletin T-714.

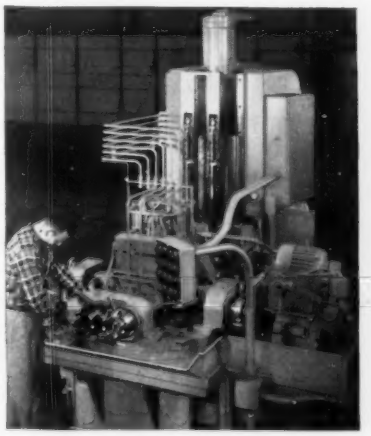


BROACHING AND MILLING

— one Sundstrand machine combines the two and cuts machining time 70%

A major opportunity for cost reduction in many shops lies in the use of multiple-operation machines. The part illustrated provides an excellent example. Formerly, the operations indicated required four machines. With the new Sundstrand machine which combines broaching and milling, parts are produced with 70% less machine time . . . reduced setup time . . . practically no rejects . . . less maintenance . . . less floor space . . . reduced operator fatigue . . . elimination of unbalanced inventory . . . better quality standards . . . less handling between machines.

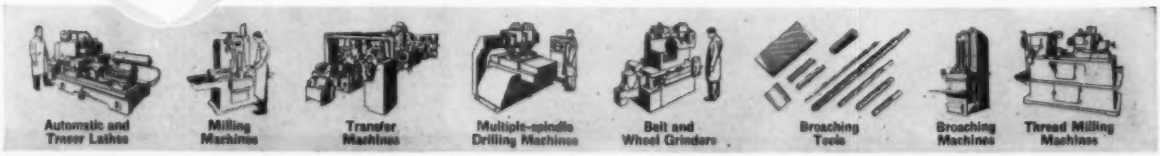
If you want to explore the opportunities for profitable multiple-operation machining in your shop, ask for details about a Sundstrand "Engineered Production" Analysis.



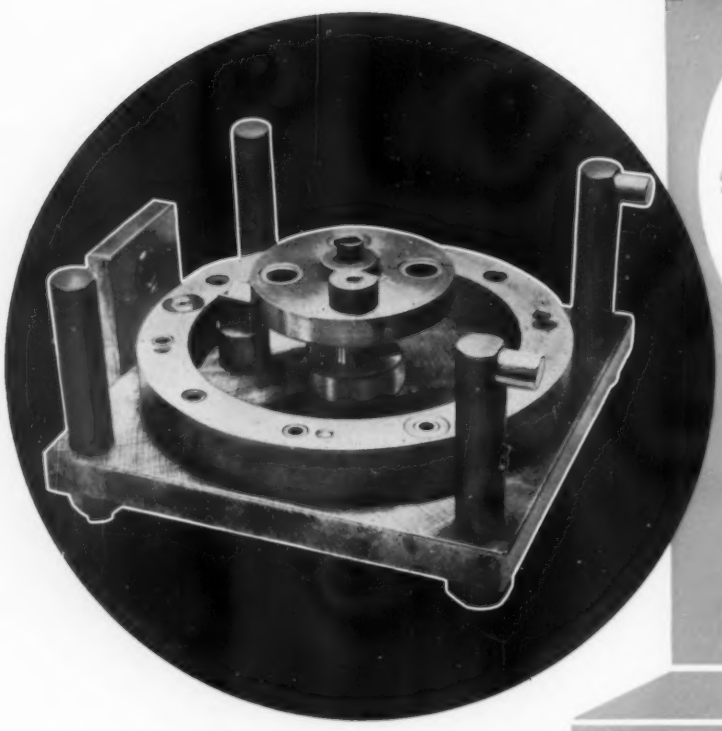
SUNDSTRAND

SUNDSTRAND MACHINE TOOL

BELVIDERE, ILLINOIS • DIVISION OF SUNDSTRAND CORPORATION



THIS DRILL JIG NOW MADE IN



LO-AIR

*Low Temperature — Air Hardening**

TOOL and DIE STEEL

Reduces Grinding and Machining Time

LO-AIR, the tool and die steel that features easy machinability and least distortion in hardening, permitted up-grading of steel in this case—as reported by Mr. Joseph Carrera, Plant Superintendent of Quality Tool and Die Company, Hoboken, N.J.—because savings in time more than made up for the difference in material cost.

The drill jig illustrated above required much less heat treating expense—and 25 hours less jig boring and jig grinding time with LO-AIR. It was formerly made of cold rolled machinery steel, which had to be carburized to provide necessary wear resistance. Also, there was a great hazard of cracking in quenching this part. LO-AIR also solved these problems.

For complete data on this and other LO-AIR applications, write for Performance Report No. 23. Also, we will gladly send you a copy of our 12-page LO-AIR brochure which contains full information on this time and money saving tool and die steel. Complete stocks available. Call our nearest warehouse or sales office for quick delivery.

*U.S. Pat. No. 2,355,224

UNIVERSAL CYCLOPS

UC STEEL

STEEL CORPORATION

EXECUTIVE OFFICES: BRIDGEVILLE, PA.

TOOL STEELS • STAINLESS STEELS • HIGH TEMPERATURE METALS

FIRST *BASIC* IMPROVEMENT IN 100 YEARS!

WOODWORTH'S POWER CHUCK

THE "Ball-Lok" DESIGN

(Patent Applied For)

FOR EXTERNAL AND INTERNAL APPLICATIONS

- TREMENDOUS GRIPPING POWER!
- POSITIVE PULL-BACK ACTION!
- COMPLETELY SEALED MECHANISM!

AN ENTIRELY NEW CONCEPT IN POWER CHUCKING!

SEE THE "Ball-Lok" IN ACTION!

ASTE TOOL SHOW

BOOTH 1351

ACCURACY YOU CAN TRUST

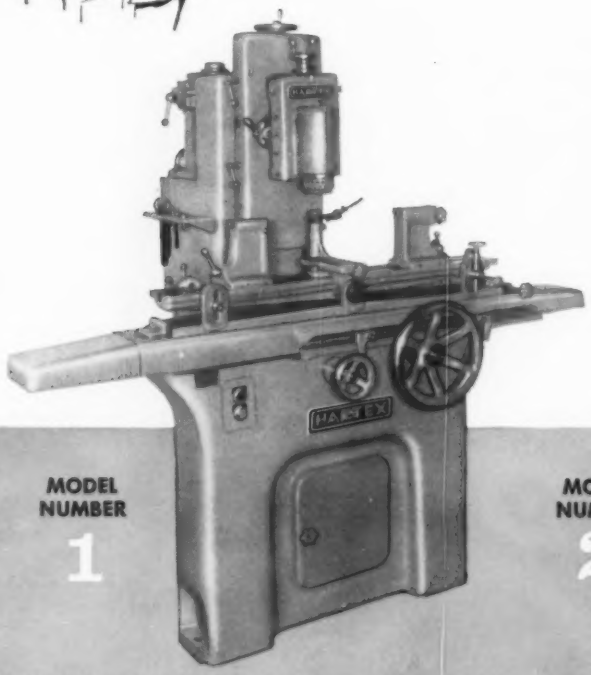
WOODWORTH

1300 EAST NINE MILE ROAD • DETROIT 20, MICHIGAN

Presenting . . .

The Cutting Tool Manufacturer's

• *Hartex Tool and Cutter Grinders were designed and developed by Union Twist Drill Company and have been proven in use by our machine operators for nearly half a century.*



MODEL NUMBER 1

UNIVERSAL CUTTER AND REAMER GRINDER

A vertical spindle grinder utilizing different types of cupped wheels for grinding clearances on straight or spiral flute cutters and reamers, mills, slitting saws, counter bores, and special cutters. Table travels on steel ball ways and fixture table tilts 5° in either direction. Swing over table is 12½" dia. — distance between centers, 31". Maximum table travel 29".

MODEL NUMBER 2

FORMED CUTTER GRINDER

This wet grinder is a hand feed machine for sharpening straight or angular gash (right or left hand) and similar form cutters. Designed so that all teeth will be ground true to the axis of the cutter, the machine maintains the rake angle of the cutter tooth with an adjustable diamond which is set with a micrometer gauge, maximum cutter diameter is 8½", cutter thickness is 3½", and maximum rake angle is 30°.

HARTEX UTD

HARTEX DIVISION (West Germany)

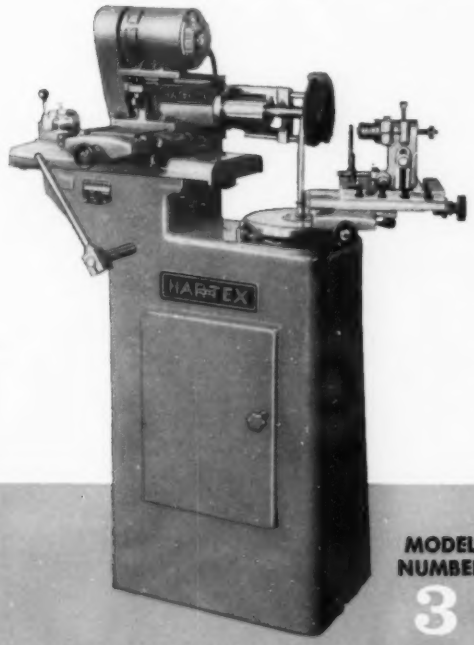
UNION

UNION TWIST DRILL COMPANY
Athol, Massachusetts

UTD

approach to cutter grinders

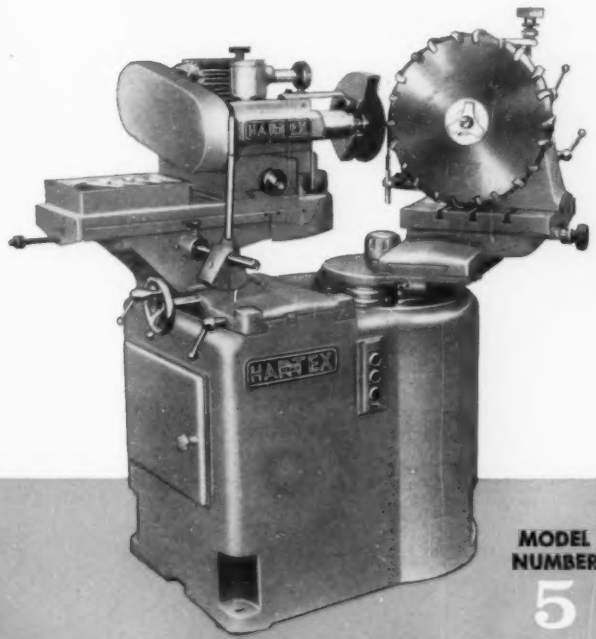
- *Modern Hartex machines are the ultimate in ease of operation, quick setup and low grinding cost.*
- *These versatile grinders quickly and efficiently restore dull cutting tools to manufacturers' original accuracy.*



MODEL NUMBER 3

TANGENT – ARC PROFILE GRINDER

It's easy to get the feel of the work on this machine since both main wheelhead slide and swiveling workhead travel on ball bearing slides. Simple, quickly changed workholders facilitate grinding of radii and clearances on straight and spiral fluted milling cutters, side mills, angular cutters, end mills and ball mills and profile type milling cutters. Capacity of wheelhead movement is 5½" laterally and 10" transversely. Workhead swivels 210° and its slides move 3¼" parallel to cutter axis and 12¾" normal to cutter axis. Radius capacity 5½" — concave or convex.



MODEL NUMBER 5

TANGENT – ARC PROFILE GRINDER

The number 5 is made for the maximum versatility in handling arbor type cutters up to 30" diameter and taper shank mills up to 18" over-all length. Despite its size it is still a positive, delicate machine in operation and will efficiently grind radii, clearances, and profiles on standard and special cutters. Capacity of wheelhead movement is 7½" laterally and 20½" transversely. Workhead swivels 210° and its slides move 11" parallel to cutter axis, 13½" normal to cutter axis, with an additional vertical adjustment of 5". Radius capacity 7½" — concave or convex.

These machines will be in operation at

BOOTH 1927
A.S.T.E. 1960 TOOL SHOW

Detroit Artillery Armory

April 21-28, 1960 Detroit, Michigan

You can get FREE LITERATURE on this line of tool and cutter grinders by sending us this coupon.

UNION TWIST DRILL CO., Athol, Mass.

Gentlemen: Please send me the catalogs for the models checked below.

- ☐ **Number 1** Universal Tool and Cutter Grinder
- ☐ **Number 2** Formed Cutter Grinder
- ☐ **Number 3** Tangent — Arc Profile Grinder
- ☐ **Number 5** Tangent — Arc Profile Grinder

Name: .....

Title: .....

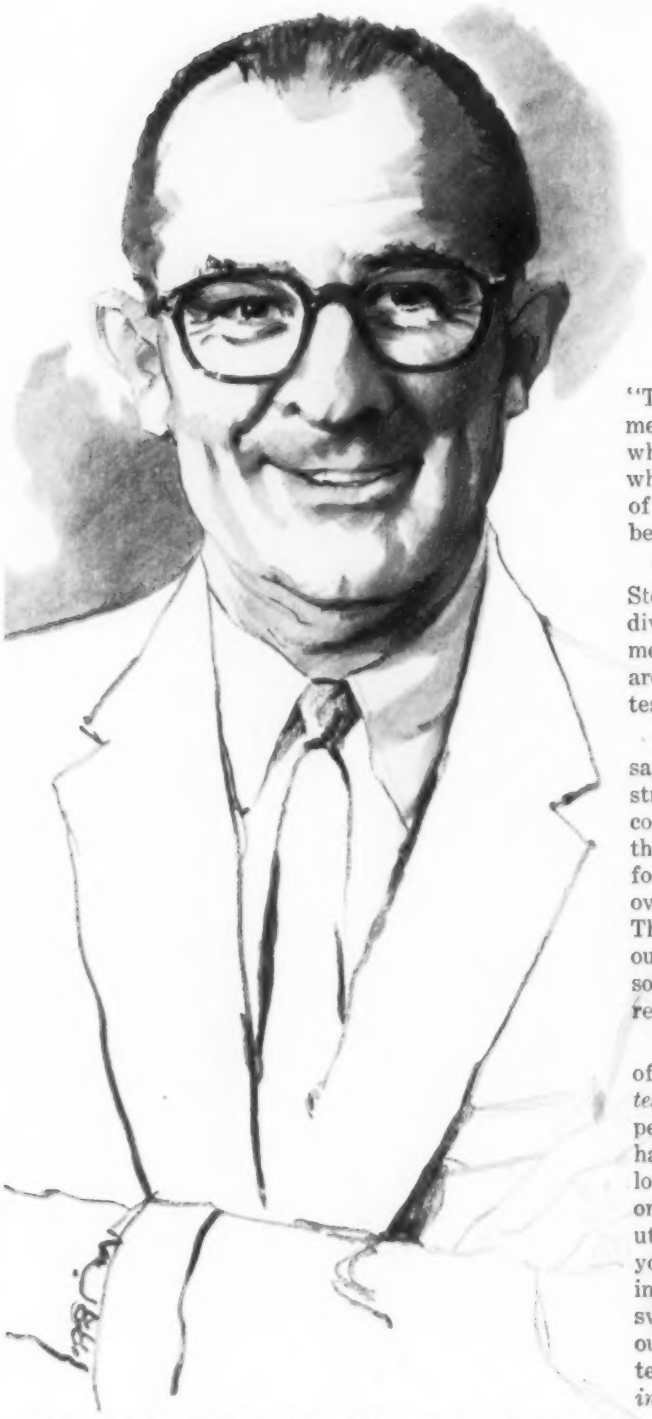
Company: .....

Street: .....

City: ..... *Zone:* ..... *State:* .....

AM

"Even our standard stock wheel



Elden L. Auker, Vice President—Marketing of Bay State Abrasives, is a man who knows the industry through years of experience both in working in the field with Bay State customers and from close association with the research and development programs at Bay State's manufacturing headquarters in Westboro, Mass.

"There's only one thing in this business that gives me a bigger kick than seeing a new Bay State wheel specification turn out successfully. That's when one of our standard wheels goes into a series of tough tests and proves it has what it takes to beat the competition.

"That's what happened recently at Omaha Steel Works. They're one of the largest and most diversified processors of structural steel, weldments and steel castings in the entire Western area of the U.S. . . . and, believe me, they are test-minded.

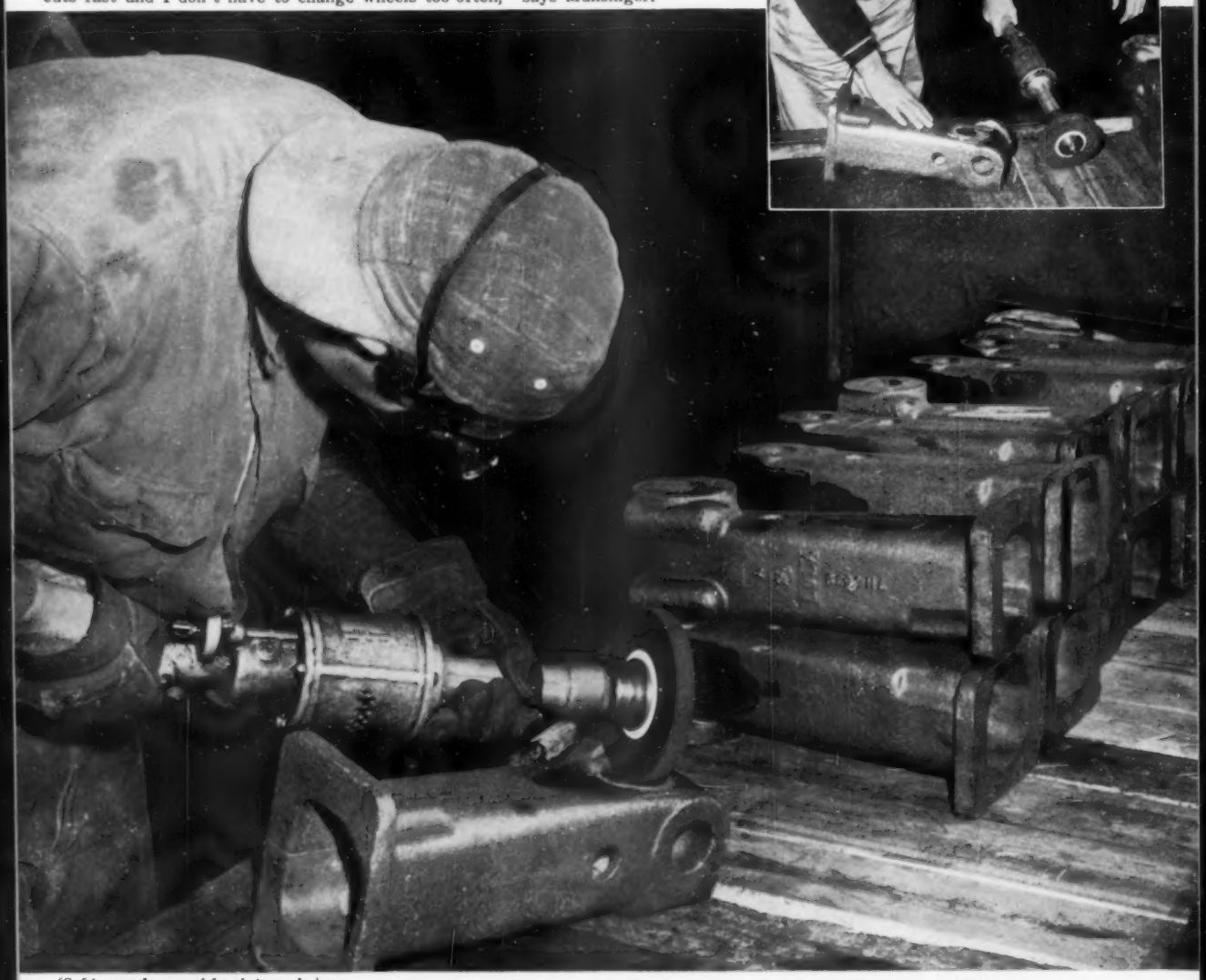
"As our own Abrasive Specialist, Gene Miller, says: 'This was one time when sales talk was strictly *verboten*. They wanted the best wheel they could get for finish-grinding steel castings and they asked all the major abrasives manufacturers for wheels to test. And, did they give them a going over! There wasn't anything they didn't check. The results showed our stock specifiication beat out all wheels in cutting speed and length of life so it cut their cost-per-hour figures and naturally reduced down-time for wheel changes, too.'

"Well, there's one example. But there are plenty of others. And they all prove the importance of *testing* . . . even testing wheels that are doing a perfectly acceptable job . . . because we may well have a standard stock wheel that could do a whole lot *better* job. In your tool room, for example, or on the production line, put your Bay State distributor or our direct representative on the trail and you could quite possibly wind up with substantially improved performance and cost figures just by switching to a standard Bay State wheel, straight out of inventory. Our people will cooperate in any tests you want to set up because . . . *better grinding at lower cost . . . that is their business.*

beat out all competition at OMAHA STEEL WORKS"

(Right) Chief Inspector Lloyd Base and Bay State Abrasive Specialist Gene Miller examine results achieved with Bay State finish-grinding wheel.

(Below) Operator Vincent Munsinger finish-grinds steel track-carrier casting with Bay State's 6 x ¾ x ⅝ wheel on a portable air grinder. "This wheel cuts fast and I don't have to change wheels too often," says Munsinger.



(Safety guard removed for photography)

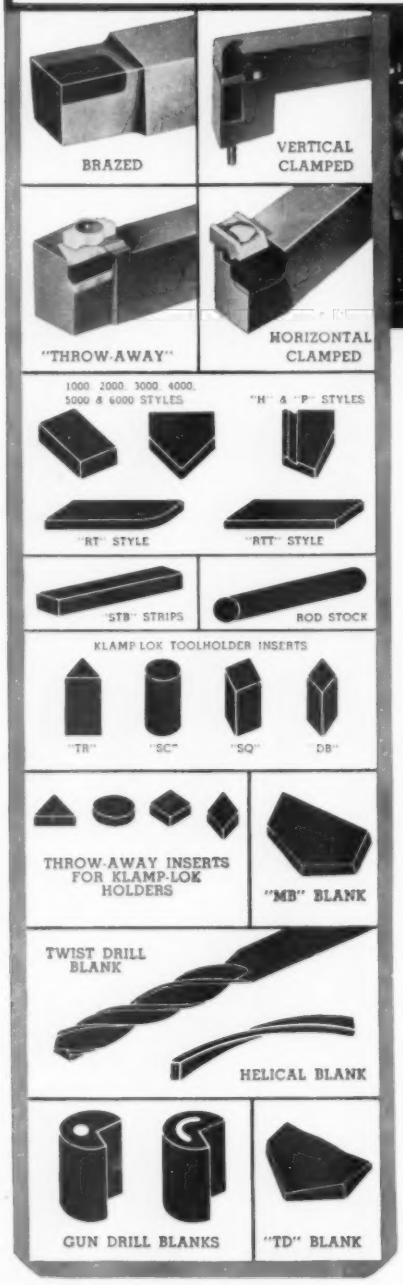
BAY STATE ABRASIVES

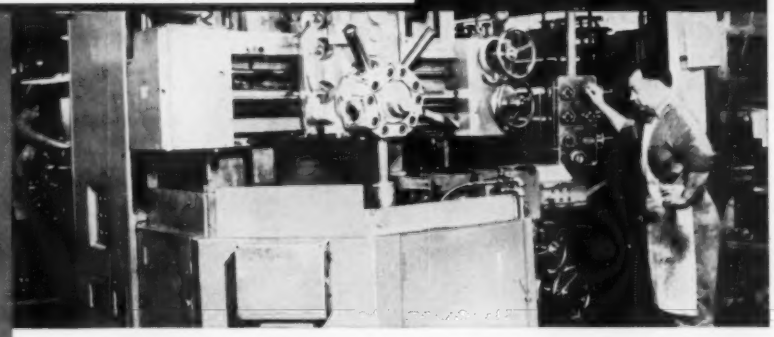
BAY STATE WHEELS of PROGRESS

Bay State Abrasive Products Co., Westboro, Massachusetts.
In Canada: Bay State Abrasive Products Co., (Canada) Ltd., Brantford, Ontario.
Branch Offices: Chicago, Cleveland, Detroit, Los Angeles, Pittsburgh. *Distributors:* All principal cities.

Use Reader Service Card, CIRCLE 57

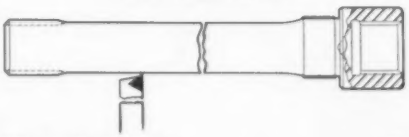
TALIDE TOOLS Produce 50% More at J.I.CASE®



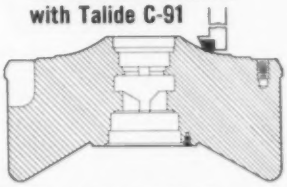


J.I.CASE® Co., Racine, Wisconsin, leading manufacturer of Agricultural and Industrial Equipment, reports Talide Tools give superior performance on both cast iron and steel jobs.

18 Shafts machined with Talide S-92



600 Wheels machined with Talide C-91



Main drive shaft 15/16" dia. x 16-15/32" long	**Part**	Rear tractor wheel 15" dia. x 7-19/32" thick
H.R. A-8640 steel 285-321 Brinell	**Material**	Hi-nickel cast iron SAE111
Turn O.D. of Shaft	**Operation**	Face outer edge of wheel hub, 1/2" wide cut
Carbo-matic	**Machine**	Bullard
#TN-163P3 Talide Disposable insert 1/2" I.C. x 3/16" thick, negative angle, 3/64" corner radii, Grade S-92	**Tools**	#GL-20 brazed tool, off-set style, 1-1/4" x 1-1/4" x 8" shank size, Grade C-91
1/16"	**Depth of Cut**	1/8" to 1/2"
.009	**Feed**	.033
115	**Speed (S.F.M.)**	210
450	**(R.P.M.)**	39
Soluble Oil	**Coolant**	dry
Talide Grade S-92	**Results**	Talide Grade C-91
Machined 18 shafts per grind. Next best premium grade produced only 12 shafts.		Machined 600 wheels per grind compared to 400 for next best premium grade.

HERE'S OUR OFFER!

Our Service Engineers will furnish and test a Talide Tool on any job you designate—free of charge. Write for Catalog 59-G. Metal Carbides Corporation, 6001 Southern Blvd., Youngstown 12, Ohio.

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HOT PRESSED AND SINTERED CARBIDES • VACUUM METALS
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OVER 25 YEARS' EXPERIENCE IN TUNGSTEN CARBIDE METALLURGY

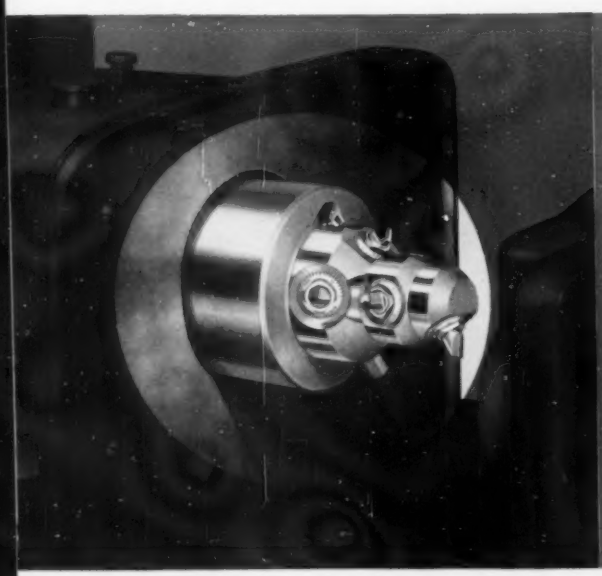
'60 ASTE TOOL SHOW

SEE IT AT BOOTH 427 ASTE SHOW, April 21-28 • DETROIT

pre-set tools to accurate part dimensions outside the machine with new Microbore® System

SIMPLE 4-STEP PROCEDURE

1. To set up pilot tool, insert Microbore "Pre-Set" unit in boring bar. Adjust to part dimension by trial cut and final setting using Micrometer Vernier adjustment.



2. Remove adjusted pilot tool from the boring bar and install in the standard Microbore setting block.

3. Position indicator anvil on high point of pilot tool in setting block and adjust indicator to zero.

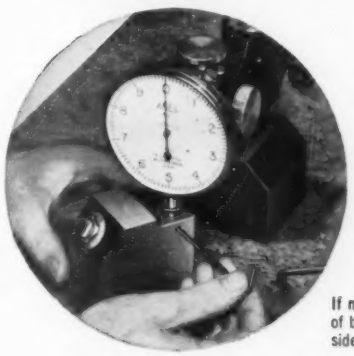
Eliminate trial cuts... change tools in seconds... simplify tool maintenance

Using a standard setting block and indicator, Microbore tools can now be pre-set to accurate part dimensions outside the machine and quickly locked in the boring bar or tool holder without further adjustment.

"Pre-Set" eliminates scrap parts due to trial and error set-up and greatly reduces down time for worn tool point adjustment. "Pre-Set" encourages the operator to keep sharp tools in the machine assuring greater accuracies and produces the maximum number of pieces per tool grind by minimizing breakage due to dull tools.

"Pre-Set" also makes it possible to replace worn tools without changing the entire boring bar or tool holder—eliminates the need for stand-by bars —simplifies tool grinding and maintenance.

Microbore System of "Pre-Set" tooling may be applied to boring, turning, facing and chamfering operations and is especially suited to production and automated operations where machines must maintain peak production on long runs. Write for complete information.



4. Adjust gage pin to same zero setting. Any number of additional tools may now be pre-set and interchanged with pilot for precision boring the same diameter.

If necessary to pre-set for depth of bore, tumble block to adjacent side and repeat procedure.

The DeVlieg Microbore System of Adjustable Precision Tooling includes Standard Microbore Boring Bars and Boring Bar Sets, Special Cluster Tooling, Flash-Change Tooling and Tool Holders, Flash-Change Replacement Bridgeport Spindles, Turret Lathe Turning Heads and Adjustable Boring Heads.

DEVLIEG® MICROBORE® SYSTEM

DE VLIEG MICROBORE • DIVISION OF DEVLIEG MACHINE COMPANY

Fair Street, Royal Oak, Michigan

Use Reader Service Card, CIRCLE 59

Really Tough Where the Power Hits the Ground—thanks to TOCCO* Induction Heating

The Eimco Corporation of Salt Lake City manufactures heavy-duty earth moving and mining equipment of many kinds. All of their equipment must be engineered for tough work in the roughest kind of terrain, and all of it runs on tractor track that must stand up to the toughest abuse.

Superior Quality

Recently Eimco installed a 100 kw, 10,000 cycle TOCCO machine for heat treating track links. This equipment assures a completely uniform hardness pattern—the same every time for one link or one million. Furthermore, the parts are drawn as well as hardened by one TOCCO machine with one operator.

Increased Production

In addition to superior quality, TOCCO increased track link production over 400%. Formerly, one man could produce 35 links per hour; now, with TOCCO, he produces 150!

Whether you're looking for product improvement, increased production, or lower unit costs, it will pay you to investigate TOCCO Induction Heating.

JUST PUSH A BUTTON

TOCCO

THE OHIO CRANKSHAFT COMPANY

Mail Coupon Today—NEW FREE Bulletin

The Ohio Crankshaft Co. • Dept. G-4, Cleveland 5, Ohio

Please send copy of "Typical Results of TOCCO Induction Hardening and Heat Treating."

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Don't Miss the Show

Come April 21, the Society will open another of its great tool shows. This one, we feel, will be the greatest.

The 28th Annual Engineering Conference and Exhibit in Detroit is the first to be held under the Society's new label—ASTME—and the first in the Society's birthplace city in almost two decades. Of further significance, the show will do much to set the stage for engineering achievement in the soaring Sixties.

One has only to read the list of exhibitors and calendar of events to appreciate the significance of the eight-day program. Every member owes it to himself and to his profession to participate.

Every effort has been made to cater to the comfort and convenience of those attending, to allow comprehensive coverage of the mammoth exposition in a reasonable time. The management of the Society has attempted to assemble the latest and the best in tool and manufacturing engineering. Exhibitors have been screened to assure high quality of presentation; rules and regulations have been made increasingly stringent.

In addition to the tool show's unexcelled display of industry's achievements, industry's talent and plans for further achievements will be on exhibit during the three dozen scientific engineering sessions. Technical paper coverage of timely subjects will be second to none. The Society has had many years of experience and enjoys an enviable reputation in this endeavor. Many of the conferences will have a direct tie-in with the exhibits and the plant tours.

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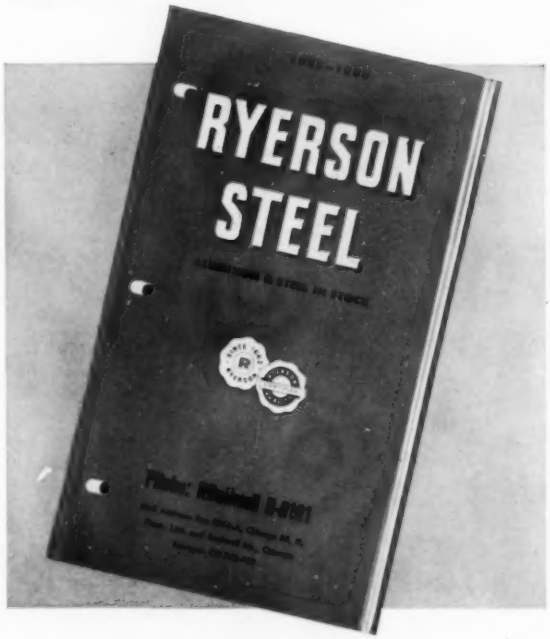

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Control key to efficient MASS PRODUCTION

By T. W. Black
Senior Associate Editor

Mass production of automobiles is a highly specialized branch of manufacturing. Despite this specialization, the basic philosophy applied by automotive manufacturing engineers can be fruitfully put to work in almost any plant.

AMERICAN TOOL AND MANUFACTURING ENGINEERS have made many significant contributions to technology. Perhaps the most important of these has been the development of mass production techniques. The availability and abundance of mass-produced automobiles, radios, refrigerators, television sets and thousands of other products has had a profound impact on the way of life in America.

The moving assembly line—the principle of bringing the work to the worker rather than bringing the worker to the work—is often considered to be the key concept in mass production. The assembly line, however, is merely one means for achieving the basic objective of mass production, which is no different from the basic objective of any manufacturing operation, high-volume or low-volume. This is to produce a desired number of high-quality products within a specified period of time at the lowest possible unit cost. The truly original concept that led to the development of mass production was the concept of manufacturing and assembly lines—and entire plants—as fully controlled systems. Control of all aspects of plant operation—the elimination of variables that affect productivity—is the key idea.

Mass production techniques first reached maturity in the automotive industry, where they are continually being refined and improved. Production of the Ford Falcon, *Fig.* 1, furnishes some outstanding examples of the many types of controls that are needed for trouble-free production.

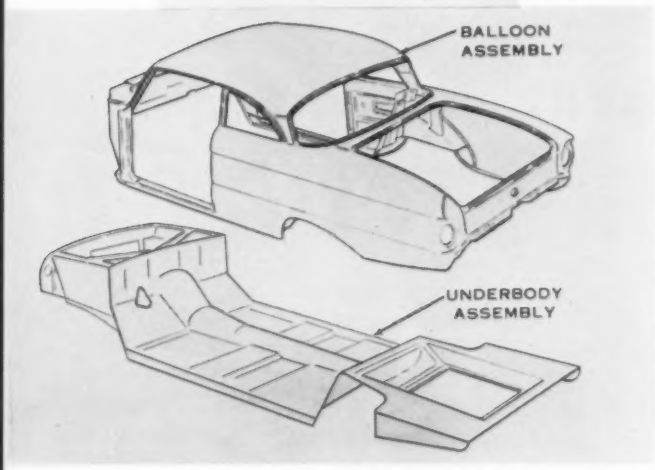
Forward Planning

Manufacturing planning for Falcon production started 18 months before the date the first Falcon came off the final assembly line. During the 18-month period, manufacturing and assembly lines were designed, machines, equipment, and tools and tooling were designed, built and tried out. Owing to this careful planning, no major difficulties were experienced when production started and the Ford plants involved in Falcon production were soon running at capacity.

This was a remarkable achievement, even in an industry that is accustomed to tooling up for frequent and major model changes. The Falcon is a

Fig. 1. Completed Ford Falcon undergoing final inspection and testing at the end of the assembly line in Ford's Lorain plant.

Fig. 2. (below) Body assembly components for Falcon two-door sedan. Underbody and balloon assemblies are joined to form a unitized body.



completely new product and none of its components were interchangeable with those on other Ford automobiles. Further, the Falcon, with its unitized body, *Fig.* 2, welded-on front structure and new type of front suspension is of a type that was completely new to Ford assembly plants and suitable equipment had to be developed and built.

Early Planning: Close coordination between manufacturing engineers and product design engineers at the time tooling was being planned was an important factor in the success of the program. At frequent meetings, manufacturing and product engineers reviewed product designs, often making modifications that made the Falcon easier to assemble without affecting styling or function. Plastic prototype models, sometimes made directly from the plasters used in styling design, were used extensively to develop design details at body structure meetings.

Owing to this coordination, the number of engineering changes required for manufacturing or assembly reasons when the Falcon reached the production stage was at a minimum. Another advantage of this cooperative effort was that manufacturing engineers, watching the body design progress, were able to anticipate tooling requirements well in advance of final design and therefore could proceed with processing on a reasonably firm basis. This made it possible to order certain long lead-time machines and tooling at the earliest possible moment.

Use of visual aids was not restricted to processing. As assembly methods and tooling were designed and tried out in a pilot plant, Ford manufacturing engineers prepared a "Here's How" book for use by assembly plant personnel. Body and final assembly operations are illustrated and described in outline in this book. A typical drawing from the book is shown in *Fig.* 3. Using the "How To" book, which was available well in advance of the date for initial Falcon production, assembly plant supervisors and foremen were able to quickly plan for the installation of new tooling and instruct workers in the new assembly techniques required.

Weld Quality: The "Here's How" book also anticipates many of the problems that might be encountered in production. One of these has to do with controlling weld quality. The unitized body is assembled with literally hundreds of spot welds. The rigidity of the body is, of course, dependent on the number and the quality of the welds. Definite practices and standards for making these welds were developed during an extended period of testing. To insure quality, each welding operation sheet carries a complete welding schedule, which includes secondary amperage, electrode force, weld time, button size at setup, minimum button size and the drawing number for the tip dresser employed. The operation sheet also carries specific instructions relative to the weld illustrated.

Carrying the philosophy of control a step further, the "Here's How" book explains the basic factors that affect weld quality in simple language. The thinking behind this discussion is that people are more apt to follow instructions if they understand the reasons for them.

Assembly Plant Operations

Operations in the Ford Lorain, Ohio assembly plant reflect the results of thoughtful and complete forward planning. This plant is one of four that produce Falcons. The methods and tooling illustrated in the "Here's How" book are applied in all four plants—another example of control, used, in this case, to insure that the best possible methods are used and that all Falcons will be of uniformly high quality, wherever they are produced.

Press Welders: The majority of body and final assembly operations are performed manually. In some instances, however, it has been possible to perform spot-welding operations automatically. This is true of front floor plan assembly and underbody assembly. Huge spot-welding presses are used for this purpose. These presses were designed and built according to detailed specifications established by Ford manufacturing engineers.

Front floor pans are welded on two press welders that are interconnected by automation equipment so that they function as one unit. The first press in the line, *Fig.* 4, is equipped with single and equalizing spot-weld guns that produce a total of 144 welds on the assembly. The second press produces up to 96 welds, completing the floor pan spot-welding operations. Welding electrodes in both presses are cooled by water circulation. All weld guns are hydraulically extended and retracted. Pressure for welding is applied by a hydraulic system.

There are two sets of fixtures on this welder. Lower fixtures are mounted on a movable platen and are designed to locate and hold the front side member extensions, seat track reinforcement brackets and front floor pan in position for welding. The fixtures incorporate locating pins and holders on which the parts to be welded are placed for alignment. Backup electrodes that oppose upper fixture welding guns during the welding cycle are also included among the lower fixtures.

The upper fixtures are mounted to the underside of the press-welder crown. They include equalizing guns that finish-weld the side members, and upper electrodes that finish-weld the seat track reinforcement brackets and weld the front side member rear extensions to the floor pan. Spring-loaded holding pads prevent movement of the parts being welded during the welding cycle. All fixtures can be removed from the press for maintenance, repair or replacement during a model changeover.

When parts have been loaded on the lower fixture, the platen rises, bringing the assembly into position for welding. Then three batteries of welding guns fire in sequence, completing the welding operation. The platen then lowers and the floor pan assembly is carried out of the machine by an ejector mechanism. Production is 80 assemblies per hour.

The entire underbody assembly is also welded on a press welder, *Fig.* 5. Like the other press welders, this welder has a moving platen and upper and lower fixtures. A total of 104 welding guns are incorporated in the welder, which joins the front structure assembly, front floor pan assembly and rear floor pan assembly to make up the completed underbody assembly.

Press welding operations are another example of control, since their use results in uniform weld quality and accurate weld location.

Manual Assembly: The body balloon assembly is built up and welded on a stationary body framing fixture, *Fig.* 6. It is joined to the underbody in a second framing fixture. The elaborate fixturing

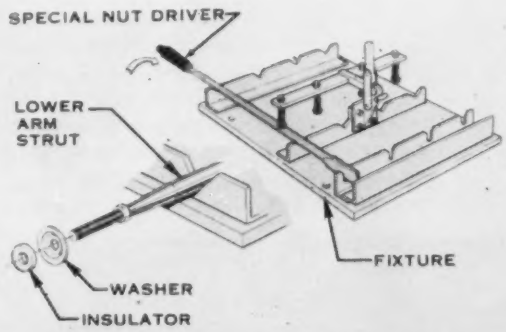


Fig. 3. Drawing from "Here's How" book shows fixturing and assembly method for lower arm strut of front suspension.

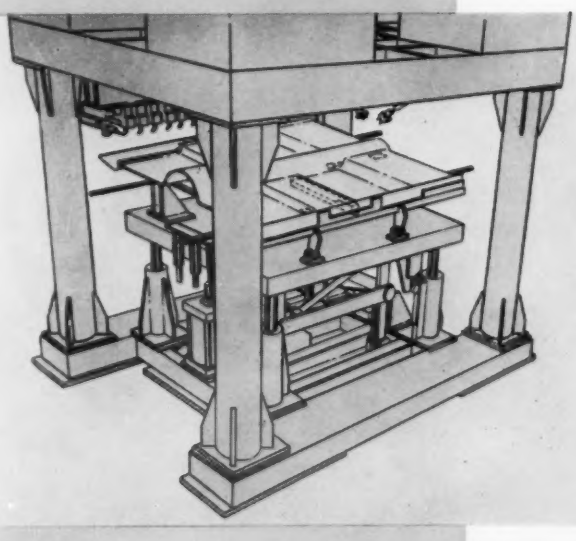


Fig. 4. Front floor pan press welder. Platen rises to lift assembly into position.

required for these operations and the relative inaccessibility of some of the weld areas make press-welding operations impracticable.

Due to the unitized construction of the Falcon body, many of the operations formerly performed on frame and chassis lines are now performed on a new underbody trim line. Bodies are secured to skids and ride on a conveyor in crosswise position. Operations on the line include front suspension adjustment, caster and camber adjustment, steering linkage installation, and brake line and fuel line installations.

The caster and camber adjustment, *Fig.* 7, is perhaps the most unusual of these operations. The caster and camber fixture is suspended by a one-ton-capacity hand-propelled bridge crane installation. Overhead monorails provide approximately 60 feet of travel in line with the conveyor and three feet of crosswise travel.

In operation, the fixture is located and securely clamped to the front structure. It then picks up the front wheel spindles and positions them to the proper caster and camber position. A hand tool is then applied to each of the four bolts that hold the front suspension upper arm pivot shafts to the body in order to determine shim requirements. Shim requirements are marked with chalk near each bolt and the fixture is then unclamped and removed from the body. Each of the bolts is subsequently shimmed as marked and secured.

Chassis are assembled on a relatively short portion of the final assembly line. Here a drive train consisting of the engine assembly, the rear axle build-up, the drive shaft and the main exhaust pipe is built up. The chassis and the body are mated in a "decking" operation, *Fig.* 8. A special saddle is used to support the body at a convenient height to facilitate the attachment of the rear springs to the body.

In the decking operation, as the body is lowered over the engine, a man in a pit directs the fore and aft positioning of the body so that the floor No. 1 crossmember is guided directly into the rear engine mount bracket. As the body is lowered further, it rests at this point in such a way that exact sidewise location is attained. The body is then lowered completely, achieving exact sidewise location at the rear in the body support saddle. Outriggers on the engine carrier under the front structure support the weight of the body, stabilizing it and eliminating unnecessary stresses.

The operations described are only a few of hundreds performed in the Falcon assembly plants. They do, however, illustrate the controls that are required for mass production assembly operations. Dimensional control is assured by accurate fixtures, such as the body framing fixtures and the caster and camber fixtures. These fixtures are designed for rapid, efficient assembly, an important factor in controlling costs. Emphasis on sound maintenance procedures also helps to keep costs down.

Quality Control: Control of the quality of the Falcon started at the time the automobile was being designed. During the clay model stage, manufac-

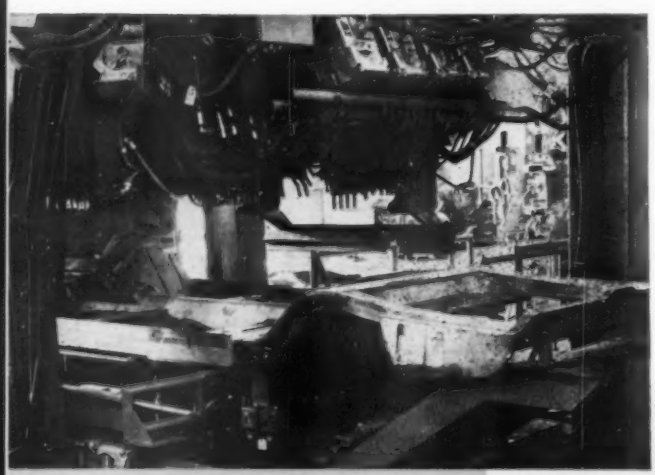


Fig. 5. Underbody press welder. The Falcon front structure, front floor pan and rear floor pan assemblies are joined in this press.

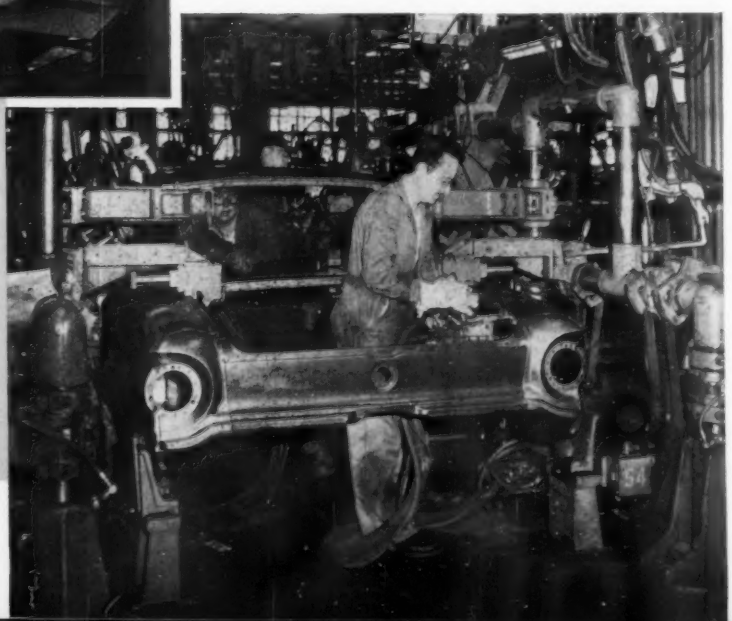


Fig. 6. (right) Body framing fixture. Heavy fixturing insures consistent quality.

Fig. 7. Caster and camber fixture is supported by a one-ton crane. Accuracy of these fixtures is frequently checked and spare fixtures are always ready for use.

turing engineers maintained liaison with product design engineers to learn of any areas that might prove troublesome from a quality standpoint in the finished product. Engineering prototypes—hand-made vehicles—were also checked by manufacturing engineers.

Development of engineering prototypes was followed by the building of manufacturing prototypes. These were assembled at the pilot plant to try out the assembly tooling and methods that would ultimately be used in production. Manufacturing and quality control engineers followed the construction of manufacturing prototypes closely, making sure that potential quality problems were resolved.

The next step was the development of "functional" automobiles that were assembled from parts that had been manufactured on the same machines and with the same tools that would be used in full-scale production. Quality control engineers checked the actual assembly operations to see if there were any unusual problems such as the faulty mating of sheet-metal parts.

Once the functional Falcon was assembled, it was checked for appearance and for operational characteristics. Simultaneously, as part of an "official initial sample" program, four to six samples of each part that goes into the Falcon were obtained. Each of these parts was manufactured with production tooling. Dimensional and laboratory checks verified their quality. Corrective action was taken if parts did not meet quality standards. The objective of the official initial sample program was to make sure that all suppliers, both inside and outside the company, corrected conditions leading to defective quality before production started.

At the start of production, quality control and process engineers who had worked on the models built in the pilot plant went to the assembly plants to furnish assistance in getting production underway smoothly.

In production, some Falcon components are checked on a 100 percent basis; others on a sampling basis. The decision as to which parts require 100 percent inspection is based on experience and, of course, on safety considerations. A quality control point at the Lorain plant is equipped to check incoming parts to destruction on a sampling basis. The results of this inspection are communicated to suppliers and to all other Falcon assembly plants.

In the processing areas, both sampling and 100 percent inspection techniques are used, again depending on safety factors and the past history of the operation. Large boards in the body construction and other areas in the plant list the major items that must be checked from a quality standpoint. Performance of the department is recorded hourly on the board by quality control inspectors.

At the end of the final assembly line, inspectors check major items. If the vehicle passes this inspection, it goes to a final acceptance line where it is given a thorough inspection by personnel using a check list. Vehicles that do not pass inspection are sent to a final repair line.

Several vehicles made on each shift are selected at random for further testing. In an inspection that takes 360 man-minutes, the vehicles are road-tested and given a thorough mechanical check. The size of the sample is large enough to give statistical validity to the results.

Detailed reports on the quality of these vehicles are made. A numerical rating system has been adopted to make over-all quality trends stand out. A

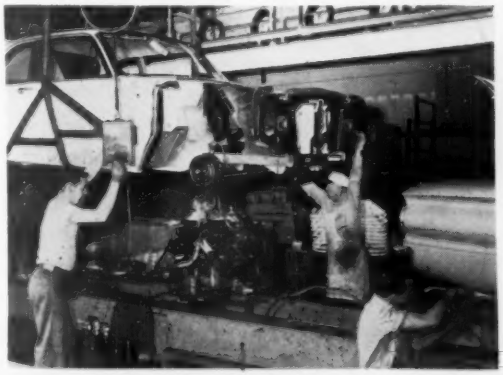


Fig. 8. Decking operation. Body and chassis are put together in this station, fastened in later stations.

Fig. 9. Sensing unit is used to detect broken drills. Machine will not cycle until broken drills are replaced by operator.

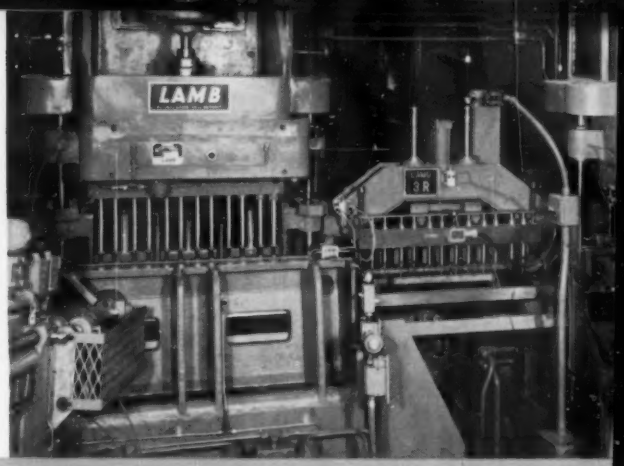


Fig. 10. After valve guide holes are drilled in machine at left, a probe unit (right) checks for broken drills in workpiece.

vehicle that is rated "10" is outstanding; a vehicle that is rated "20" is of lesser quality and so on. There is a close relation between these numbers and the number of field repairs required for the products of any given plant. The numerical rating gives management a good tool for checking quality trends.

Quality control continues after a Falcon is in a customer's hands. About 70 dealers are members of a quality control panel. Ford field representatives check the dealer's actual shop work orders for repairs on Falcons. This information is used to determine trouble areas, which are then corrected on future production models. Feedback of this kind leads to continuous quality improvement and is another example of the many controls used in mass production manufacturing.

Engine Plant Operations

Falcon engines are produced in the Ford Lima (Ohio) plant. Machining operations in this plant are fully automated, as are many inspection and assembly operations. The cylinder head line contains examples of all three. Operations are as follows:

Operation 10—Finish broach rocker arm cover side rails, rocker arm support pads, top of spring seat bosses, exhaust manifold pads, manufacturing lugs; semifinish broach joint face, using a Cincinnati two-way horizontal broaching machine.

Operation 20—Mill, drill, chamfer, counterbore, ream on a 56-station Lamb transfer machine.

Operation 30—Finish broach the combustion chamber joint face in a Cincinnati tunnel type broach.

Operation 40—Drill and gun ream valve guide holes, finish valve seats, tap, in a 20-station Lamb transfer machine.

Operation 50—Wash and flush, using a Centri-Spray machine.

Operation 60—Inspect valve guide holes on a Sheffield automatic gage.

Operation 70—Assemble four cup plugs in sides of heads in a Wilson automatic cup plug assembly machine.

Operation 80—Assemble cup plugs in intake manifold ends, also one plug in rear water jacket, in a Wilson assembly machine.

Operation 90—Test water jackets and intake ports in an Apex leak test machine.

All machines in the line are linked by automatic transfer equipment, making the entire line an integrated production system. Once the heads are positioned on the line, no further manual operations are required. Production is about 80 heads per hour. This automation has made it possible to fully control machining costs and cylinder head quality.

Transfer Machines: The two Lamb transfer machines—which can actually be regarded as two sections of one 76-station machine—were both converted from transfer machines used for production of eight-cylinder engine heads. This was a major rebuilding project. The Falcon heads are 26.74 inches long, 5.5 inches wide, while the eight-cylinder heads were 22.36 inches long and 7.375 inches wide. The difference in length meant that it was necessary to change the station-to-station distances on the machine and to perform other major modifications.

To make the conversion, the machine was sent to the builder's plant. About 1500 engineering man-hours were required to complete the redesign. In a conversion of this kind, it is usually possible to utilize the machine bases, angular columns and other large castings. The slide and power units, electrical units and hydraulic units are also normally utilized. All wiring and piping is completely new and, in the case of this machine, all fixtures were completely new, as were the transfer mechanisms that move parts from station to station and the drilling heads.

In making the conversion, each machine component was considered on its own merits. Compo-

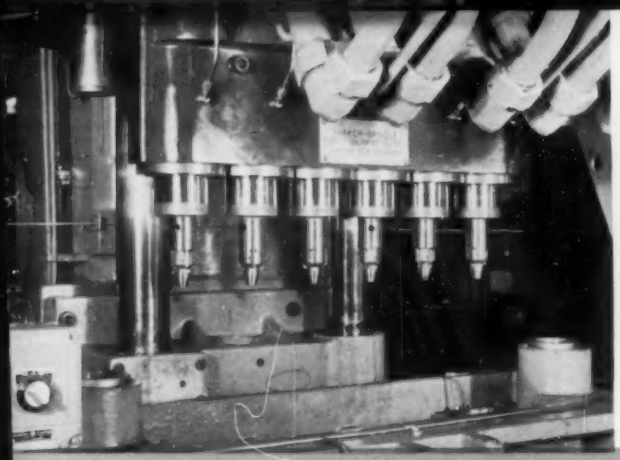


Fig. 11. Combination tools form cylinder head valve seats and ream valve stem holes. Reamers are in retracted position here.

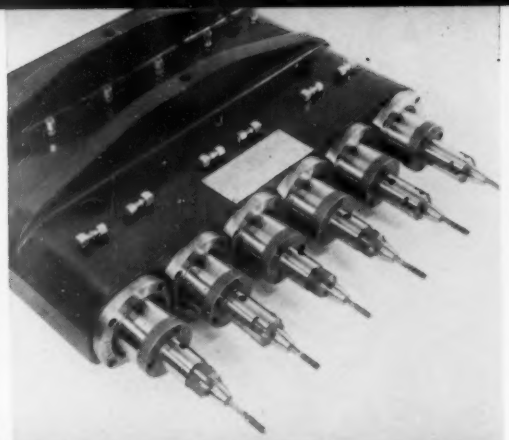


Fig. 12. Drilling unit with reamers extended. This unit can be quickly removed and replaced with a spare when adjustments are needed.

nents that were not required for the converted machine were, of course, discarded. The basic machine was stripped down and all components were steam cleaned and tested. Defective components were replaced or repaired. The converted machine was in "like new" condition when it was returned to the Lima plant.

A basic principle of mass production control—detecting and correcting trouble when it happens—is illustrated by the sensing units used to detect broken drills, *Fig.* 9. The drill passes through a sensing unit containing a magnetic coil connected to the machine's electrical control system. If the sensing unit detects the drill, the operation procedes normally. If the drill is broken off (which means that the sensing unit doesn't detect anything) the machine stops and the location of the trouble is signalled on the machine control panel.

Another control device is the probing unit following the station in which valve guide holes are drilled, *Fig.* 10. Each of the 12 holes is mechanically probed to detect broken drills. All probes are independently mounted. When the probes are lowered into the holes, a broken drill in any one hole stops the probe. The upper end of the probe then contacts a metal plate that is lowered with the probing head, causing the plate to lift or tilt. This in turn causes a limit switch to trip, stopping the machine and signalling the operator. Use of the plate arrangement makes it possible to use only one limit switch, with consequent savings in initial cost and maintenance.

Hole-to-hole distances, hole sizes and hole finishes are closely controlled. The head used for finish forming of valve seats and gun reaming of stem holes, *Fig.* 11, is an example of the precision tooling used. The reamers are retracted while the valve seats are being finished. After the valve seats are machined, which is accomplished at a speed of 500 rpm, the reamers descend into position and finish the stem holes at 3000 rpm. Oil-mist lubrication is used. Concentricity is assured by this arrangement, and hole-to-hole distances are maintained at all times since all six spindles are mounted in the same head. To speed maintenance, the entire head, *Fig.* 12, can be quickly removed and replaced with a spare unit.

Cylinder heads are machined in seven different positions as they travel through the two sections of the transfer machine. Automation equipment such as the compound turn device shown in *Fig.* 13, turns the block end-for-end, on its side or in any other position required for machining. Limit switches stop the machine in the event that a block is positioned improperly. This prevents possible damage to the machine and tools.

Automatic Gaging: Diameter and straightness of valve guide bores are checked on a Sheffield automatic machine, *Fig.* 14. This machine has 12 combination spindles. The diameters of the 12 bores are simultaneously checked to tolerances of 0.001 inch, following which a "Go" check is made on the straightness of the bores as a straightness sleeve goes through the entire length of the bore.

If diameter and straightness are both acceptable, a transfer unit in the gage moves the part on to an acceptable part track. Out-of-tolerance parts are shunted onto a reject track. The machine is capable of inspecting and segregating up to 100 parts per hour.

In checking diameter, the spindles rotate 90 degrees at the top of the bore and then proceed to the bottom where they rotate backwards 90 degrees. Open-jet air gaging spindles are used, giving a chordal diameter reading at the point checked.

Control units convert the pneumatic size sensing impulse at each gage point into electrical signals to actuate the accept or reject mechanism. If any one dimension is out-of-tolerance or a straightness

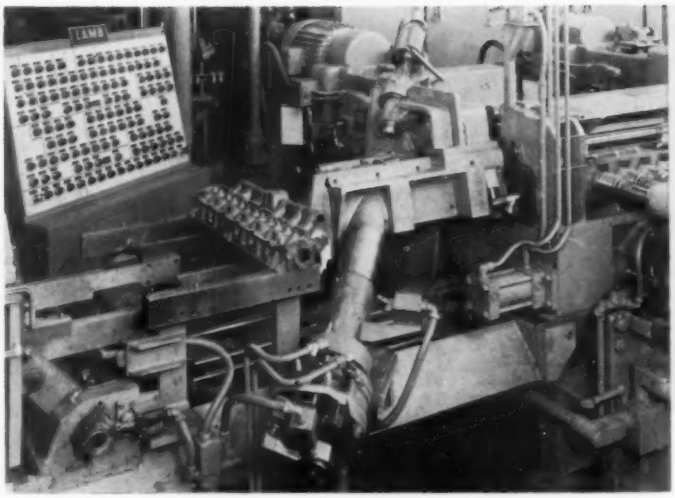


Fig. 13. Compound turn device lifts cylinder heads from a conveyor, turns them on their sides in position for next operation in transfer machine.

sleeve fails to go through the bore, a memory circuit is energized to reject the part after it leaves the gaging station.

Although the 12 spindles enter the head simultaneously, each spindle is individually mounted to prevent machine stoppage in the event of a missing bore or a jam condition. Each spindle floats approximately 0.030 inch to accommodate bore misalignment.

Pneumatic mechanisms transfer the part through the gage. The part is located during gaging by two shot pins. Lubrication is automatic.

Assembly Machine: The machine used to assemble cup plugs into the head, *Fig.* 15, is completely automatic. This machine presses four plugs into the side of the head. In the first station, sealing compound is swabbed into the cup plug recesses. Next is an idle station, followed by the first assembly station, where two plugs are pressed into the holes. Two more plugs are inserted at the succeeding station. The plugs are fed, two at a time, from vibrating hoppers. They are oriented by the vibrating hopper before passing into chutes that carry them into the pressing stations. The escapement mechanism is designed so that out-of-tolerance plugs are automatically rejected before they are in feeding position.

The transfer mechanism is hydraulically actuated and is of the walking-beam type. There are separate cylinders for raising and lowering the heads in the assembly stations. The heads are hydraulically clamped in each working station.

As is the case with the other machines in the cylinder head line, the hydraulic power unit of the assembly machine is physically separate from the

Fig. 14. Automatic inspection machine checks 12 holes, shunts rejects onto appropriate conveyor.

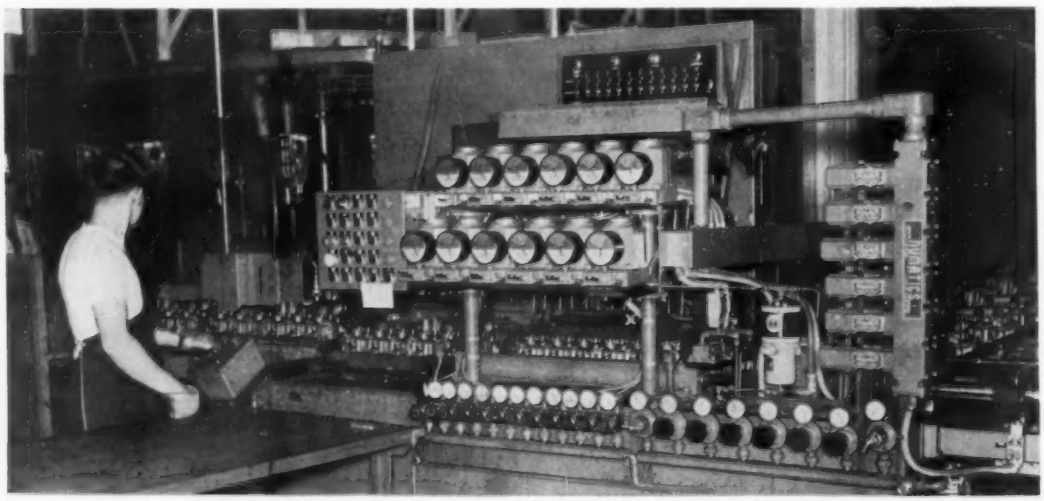


Fig. 15. Cup plugs are fed from vibrating hoppers in top of this machine and are automatically assembled into cylinder heads.

machine proper. This greatly facilitates maintenance. All valves are located adjacent to the hydraulic power unit, which simplifies maintenance.

Leak Test: Leak testing is an important part of cylinder head manufacture. Despite the many controls used in the foundry, an occasional cylinder head has slightly porous areas. All cylinder heads are tested for leaks in an Apex transfer machine that is an integral part of the cylinder head line. The machine has two stations: the first for checking the water jacket and the second for checking intake and exhaust ports. Each acceptable unit is identified with an automatic spray of paint.

In operation, the part is positioned by locators and hydraulically clamped with neoprene plungers that seal all openings. All cavities of the head are then filled with air to a predetermined pressure. Instruments on the machine detect and register leaks. The air test is much faster than water testing. A ten-second air test can detect leaks that would require three minutes to detect under water.

In a sensitive test of this kind, there is always a possibility that leaks within the machine itself will cause false readings. A certain degree of protection against false readings has been built into the testing machine for this reason. If the machine registers five consecutive "leakers"—an extremely unlikely event—the machine stops automatically and an operator checks the machine itself. Panels containing the valves and wiring are designed so they can be quickly removed as a unit and replaced with an extra unit.

This machine, like the other machines in the line, was designed and built according to specifications established by Ford manufacturing engineers.

Mass Production Principles

From the examples given, it is apparent that some general conclusions concerning the ground rules for mass production manufacturing can be drawn:

1. Start manufacturing planning at the time a product is being designed. In this way product designs that might cause manufacturing difficulties can be resolved and the need for special machines or tooling for new products can be studied.
2. Plan every detail of a production line—machines, methods, tools and tooling—well in advance of scheduled production dates.
3. Provide the greatest degree of automaticity that is consistent with product design, volume and economic considerations. (Each operation must be studied separately.)
4. Study the possibility of converting existing machines when tooling for new products.
5. Make sure that production personnel know what to do. Provide visual aids such as prototype models and perspective sketches where necessary.
6. Provide adequate fixturing for all operations.
7. Integrate inspection operations with manufacturing operations, with inspection immediately following the manufacturing operation wherever possible. (This will eliminate performing operations on a part or assembly that, because of unsatisfactory previous operations, will not pass final inspection.)
8. Provide safeguards against machine malfunctions.
9. Consider ease of maintenance and reliability when specifying machines, tools and tooling.
10. Control maintenance problems—and quality problems—by planned preventive maintenance.
11. Have a planned quality control program—with good feedback to management.

These, then, are some of the basic rules used by Ford engineers. Although the rules have been developed for mass production systems, they can profitably be applied to the operations in almost any plant, large or small.

Control key to efficient SMALL-LOT PRODUCTION

Among the more difficult tasks faced by tool engineers is the efficient production of small lots. Numerical control has proved to be an answer to many problems and provides a powerful tooling technique for low-volume work.

By Robert Heslen
Associate Editor

DETROIT TYPE AUTOMATION generally means high-volume transfer-line production. But even in Detroit, much of the work actually done is short-run manufacturing. The nature of the product and the market, of course, determine whether high-volume or low-volume manufacturing methods can be used. Detroit Diesel Engine Div. of General Motors is a manufacturer which finds itself, by the nature of the product and the competitive market, involved in short-run work. For, although the engines are produced at relatively high volume, on transfer lines, much of the product must be produced by short-run methods, *Fig.* 1. Two interesting examples illustrate the potentials of numerical control for efficient short-run production.

Flywheel Housing

Diesel engines, being used in a great variety of applications, require different accessories and accessory locations. This affects the design of engine parts, such as the flywheel housing shown in *Fig.* 2.

The flywheel housing is currently built in 168 versions and is used on 13 of the 15 engine models produced. Some of the variation in the flywheel housing is caused by the variety of starter locations, as shown in *Fig.* 3, required for various applications. Three variables affect location of the starter: (1) It may be located on any one of six different radii corresponding to six different ring gears; (2) it can be placed in several different places on the circumference of the ring gear; and (3) the starter can be rotated about its own axis. Nineteen different locations exist in all.

The job runs 10 to 500 pieces per batch. That is, 5 or 10 different setups can be required the same day, or a given setup can run several days. The requirements are somewhere between transfer-line work and job-shop operation. Criteria to satisfy include minimum over-all expenditure, minimum operator fatigue, maximum operator safety, fast change-over and economical operation.

A few years ago it was impossible to satisfy such conditions, but the breakthrough provided by numerical control makes automated short-run production feasible. The machine selected, *Fig.* 1, is a standard three-station machine equipped with a tape-controlled positioning table. Travel is 72 inches along the X axis and 30 inches along the Y axis. The table moves through four speed ranges, starting at 160 ipm in rapid traverse and moving at 0.3 ipm to the final location. Approach to the

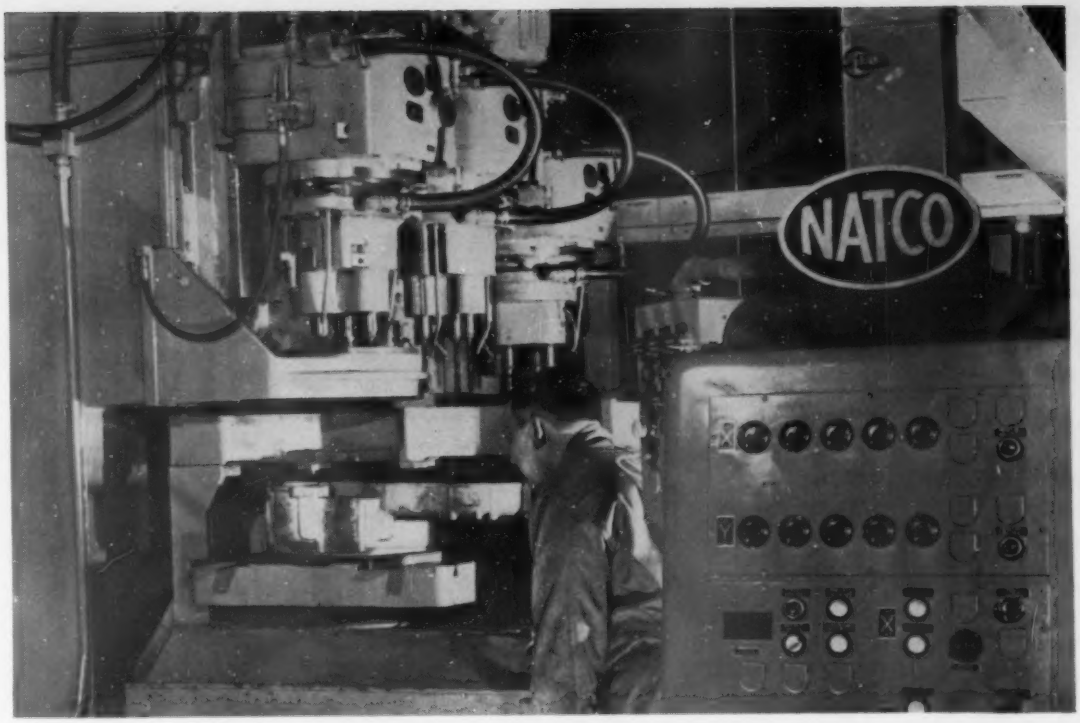


Fig. 1. An air-operated elevator lifts the housing to the bridge fixture level.

final location is always made from the same direction. The machine repeats cycles to a maximum deviation of ± 0.001 inch. Each of the three protractor type heads shown in *Fig.* 4 can be set radially in three minutes or less. To relocate a head, the cam-lock handle at the right of the head is released, the head manually rotated, and the cam retightened. The infeed end of the machine is equipped with an air-operated elevator for hoisting stock to the bridge visible in *Fig.* 1.

System Operation: Tape preparation is relatively simple. Working from original data provided in the form of a production blueprint, the part planner prepares an operation sheet. The *Y* coordinate of the starter hole centerline is constant for all three stations and is lifted directly from the blueprint. The *X* coordinate for the first station is calculated by simple trigonometry from the radius and the *Y* coordinate. The *X* coordinate at station two is 24 inches more than at station one; at station three it is 48 inches more. The angle to which the protractor head is set is then determined, and auxiliary functions indicated. Operation sheet information is punched onto the tape by means of a special punch whose keyboard layout corresponds to the operation sheet layout. Since the job is usually repetitive, three operational cycles are punched, and the tape is spliced to form a loop.

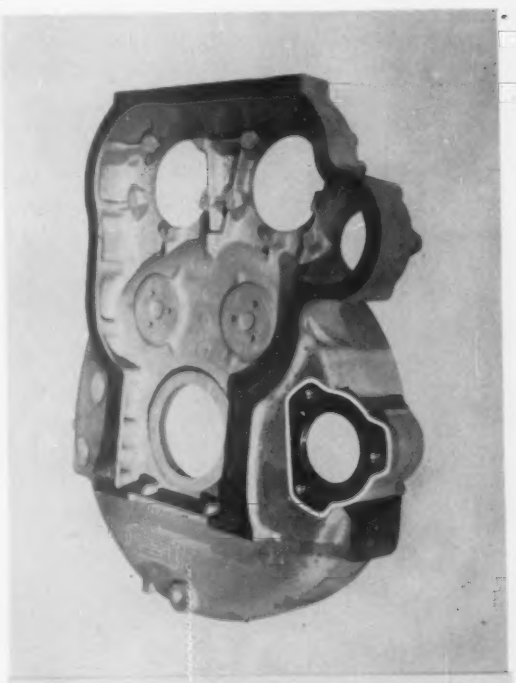


Fig. 2. One of 168 different versions of diesel-engine flywheel housings.

On the production floor, loading a tape into the reader takes about two minutes. Rotating the heads, as mentioned, takes about three minutes. Checking the setup takes about five minutes. Parts are rolled off the main conveyor onto the elevator, *Fig.* 1, in front of the fixture. The engine face of the housing is standardized so that locating pins are common for all housings. A turn of the air valve raises the elevator to fixture loading height (variable, depending on the thickness of the housing). The piece is pushed into the fixture and clamped up against the fixture bridge.

Pressing the cycle start button turns machine control over to the tape. The workpiece moves along the *X* and *Y* axes to the first head to bore and chamfer the starter hole, spot drill and chamfer the bolt holes. At the completion of the boring cycle, the table automatically moves to the second work station (in *X* only) where the bolt holes are drilled. When the drill head retracts, the table moves again, to station three, where the tap head performs the final operation on the housing. The positioning table then returns to start position for off-loading. Cycle time is 208 seconds.

When a different piece comes off the conveyor, the machine is readied in 5 or 10 minutes. When a design change occurs in the starter location, the new housing can be produced in less than an hour, including tape preparation, change-over and machining. It would, of course, be possible to dial in the coordinates for the machining operations on a newly designed part, but it is doubtful whether this is faster than tape operation, and tape operation has the advantage of being less prone to human errors.

Operational experience during the past 20 months indicates that the decision to acquire tape-controlled equipment for this job was sound. Its initial cost was competitive with other methods. Tool and manufacturing engineers were able to handle both current and new models with the same piece of equipment. Only one fixture is required; no new fixturing has been needed since acquisition of the machine. With tape, setup time is considerably reduced compared to the previous method. When 50 to 55 change-overs occur each month, setup becomes an important part of manufacturing cost. Scrap has been reduced because numerical control has eliminated many possibilities for human error.

Special Parts Machining

Because of the need to satisfy a customer's exact needs in an engine application, engines may be specified with nonstandard components. The nonstandard manufacturing required by special engines caused the development of a "miscellaneous machining" department. Both service parts and special parts, most of them short runs of 5 to 50 pieces, are fed into this department. One-shot, short-run production of this sort is difficult to handle; it approaches job-shop operation. But pure job-shop methods are ruled out by the need for economical manufacture forced by the competitive situation. Production type tooling would be too costly for the

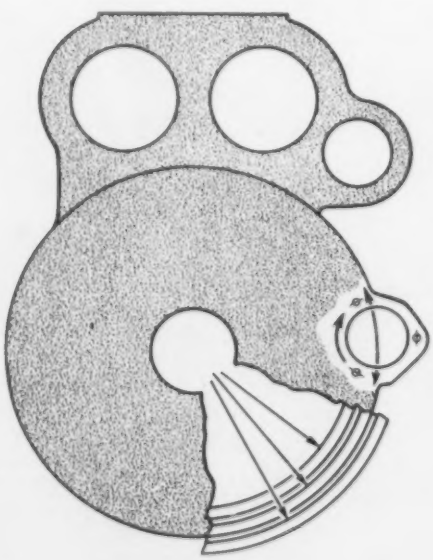


Fig. 3. Three variables affect location of the starter on the flywheel housing.

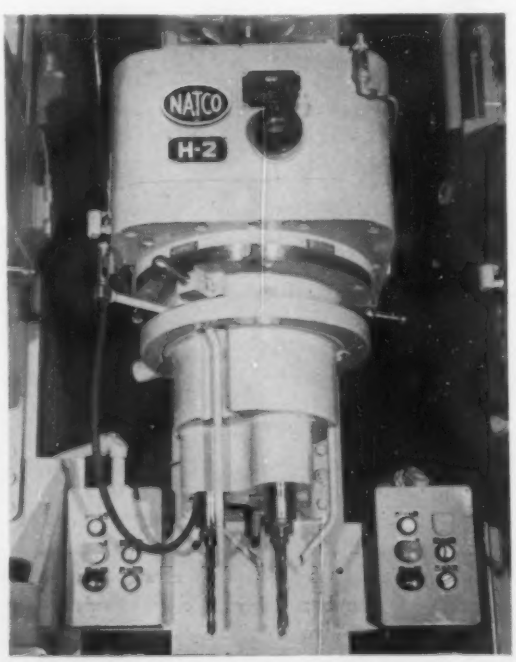


Fig. 4. Protractor heads at each station are rotated to fit the starter hole configuration.

limited number of parts run. This is always a difficult problem, typical of low-volume production.

To solve the problem, engineers turned once again to the use of numerical control. This decision was probably influenced by the success of numerical control for the flywheel housing job. Acquisition of the Milwaukee-Matic shown in *Fig.* 5 was justified by anticipated savings in several areas. New models and new options require new parts in runs of 5 to 50 pieces. Except for simple holding fixtures, no new fixtures are needed to run these jobs. No layouts are required, setup time is reduced, less floor space is used, and lead time is shorter, all of which reduces costs. The full effect of reduced lead time has not yet been entirely measured, but it will make the company more competitive on engine deliveries and may reduce inventories. Floor-to-floor time is reduced by an estimated 70 percent, since the tape-controlled machine is working about 90 percent of the time compared to the low use factor of conventional machines.

The machine shown in *Fig.* 5 is equipped with a pallet shuttle and tool selector magazine. Tool movements are in three axes, *X*, *Y* and *Z*, and the table can be rotated in five degree increments. All tool selection, shuttle and machine movements operate from a tape prepared on a Flexowriter—no computer is required. The control unit has two tape readers, so that job change-over does not cut into cycle time. In 12 seconds the pallet shuttles a new job into work position, and the second tape reader, loaded with the appropriate tape, begins directing the machining of the new piece.

An example of the work done on this machine is

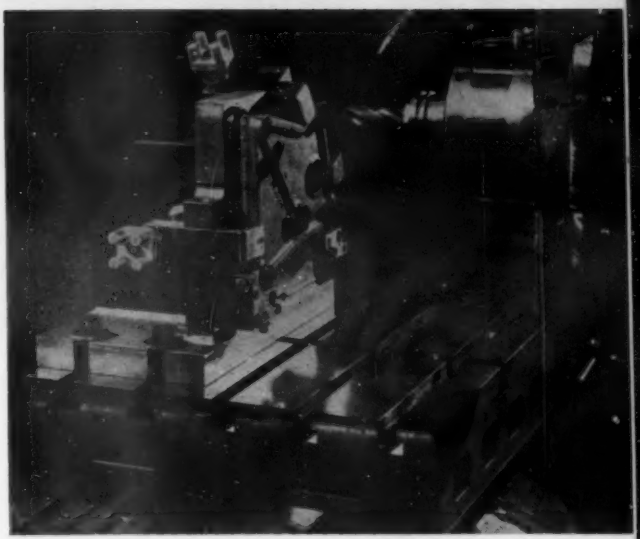


Fig. 6. The workpiece is loaded in the holding fixture and the pallet shuttles into machining position.

the fan bracket support shown in *Fig.* 6. Fixturing is relatively simple and was made to satisfy three criteria: (1) It is for holding only; (2) it must be rigid; and (3) it must provide maximum accessibility to all faces to be machined. Machining operations on this piece require use of the seven tools shown in *Fig.* 7. Each tool is preset and coded by rings on the toolholder.

Once coded, the tools are placed in the magazine in any order and are code-selected as required for the following operations:

1. Face mill pads

Fig. 5. Milwaukee-Matic for automating short-run production.

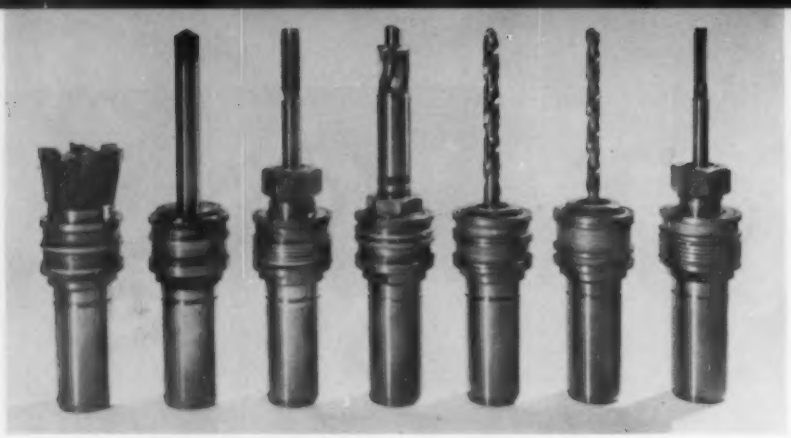


Fig. 7. Preset and coded tools are ready for loading into the tool selector magazine.

2. Spot drill six holes
3. Drill $^{17}/_{32}$-inch-diameter holes
4. Drill $^{27}/_{32}$-inch-diameter holes
5. Counterbore 1-inch-diameter shoulder on flanged hole
6. Tap two $^{27}/_{64}$-inch holes
7. Tap one $^{17}/_{32}$-inch hole.

Each of these operations requires a number of machine movements. For example, on Operation 1, the tape directs these steps:

1. Preselect face mill, rotate spindle clockwise
2. Transfer preselected tool from magazine into spindle
3. Position at rapid traverse rate
4. Turn coolant on. Preselect tool for Operation 2
5. Mill first pad at 5 ipm
6. Position to next pad at rapid traverse rate
7. Mill next pad at 5 ipm.

This sequence is repeated for the remaining pads. An auxiliary function code on the tape turns coolant off at the end of this operation.

The tool engineer selects the tools, holding fixture, and prepares the taped instructions. On the production floor the operator loads the tools in the magazine, the workpiece in the fixture and the tape in the tape reader. He gives the job to the control unit when he presses the cycle start button.

Fig. 8. The fan bracket support is machined in less than 15 minutes.

On this job, initial setup was about 15 minutes, the machining time was even less, and subsequent loading and offloading required two or three minutes each. The finished piece is shown in *Fig.* 8. If two tapes and two fixtures had been prepared load and offload could have been done during the work cycle, so that floor-to-floor time on the second and subsequent pieces would have been pallet shuttle time (about 12 seconds) plus machining time. Actually, only one fixture and one tape was felt to be justified for this run of fan bracket supports.

The advent of numerical control gives tool engineers a new means of manufacturing economically in small lots. These two examples illustrate that creative tool engineers are currently using this method advantageously. The results acquired prove the value potential that tape-controlled machines have in tooling for low-volume production.

Special thanks are due Charles Karrer, master mechanic, and Donald Adams, senior processor, both of Detroit Diesel, for the invaluable assistance they provided in supplying illustrations and information for this article.

Correction: In the article by J. L. Remmerswaal on machining cast iron in the February issue of THE TOOL ENGINEER, the two equations on page 119 read:

$$N = \frac{P_v\ V}{10.5(60)}$$

and

$$V_{max} = \frac{530N}{P_v}$$

These equations should read:

$$N = \frac{P_v\ V}{550(60)}$$

and

$$V_{max} = \frac{33{,}000\ N}{P_v}$$

The charts based on the calculations using these formulas, however, are correct. The letter pointing out the error is printed in "Readers' Viewpoint" section on page 324.

Gadgets

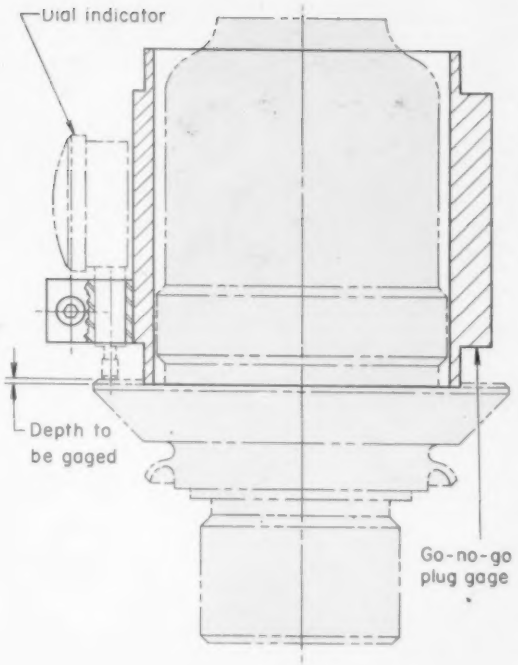
Ingenious Devices And Ideas To Help
The Tool Engineer In His Daily Work

Combination Trepan Gage

Trepan grooves are being used more and more frequently in the design of new products, particularly for use with O-rings for sealing applications. Such applications require close tolerances. Parts on which the groove is located close to an adjacent diameter present a measuring problem.

The combination gage shown is a relatively simple and inexpensive solution. A special plug gage with inside clearance to slip over the part is used for gaging the larger diameter of the trepan groove. By attaching a clamp block to hold a standard dial indicator, the depth dimension can be gaged simultaneously with the diameter.

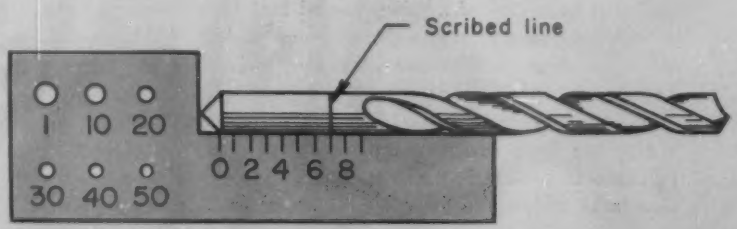
W. Russell Eldridge
Little Rhody Chapter

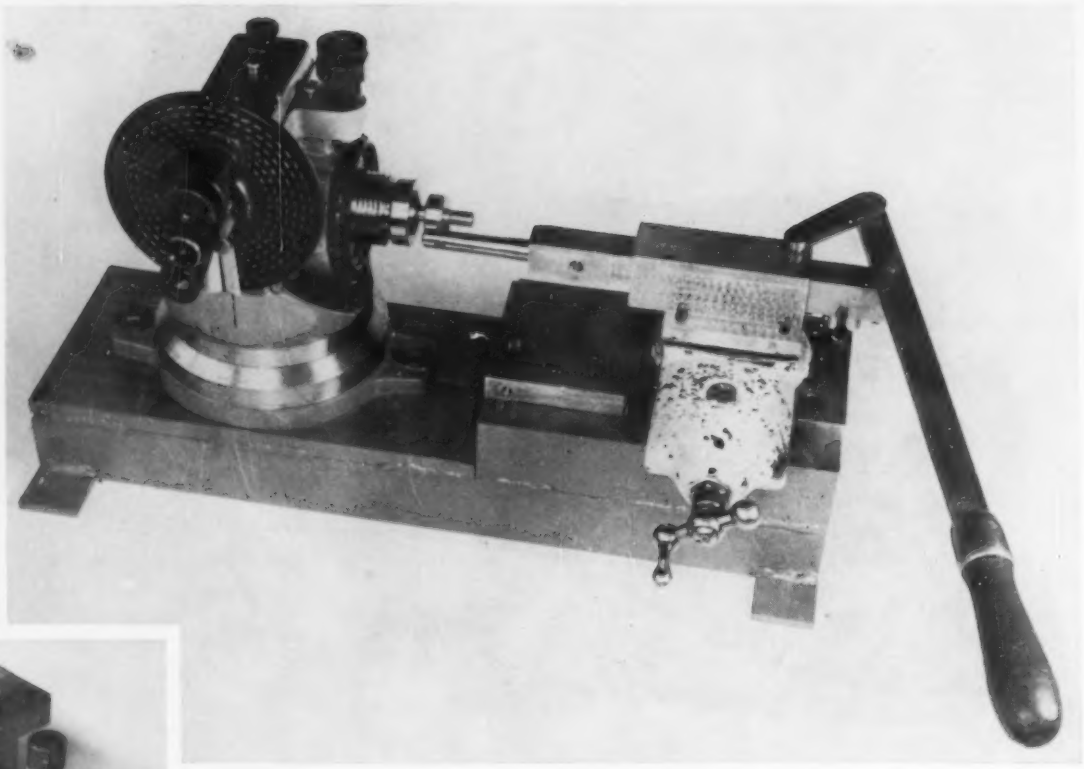


Drill Gage

Many shops make extensive use of wire gage drills. The drill gage illustrated speeds sorting these drills and eliminates the need for using a micrometer or drill gage plate. As the drills are purchased a shallow groove is marked with a file an appropriate distance from the end as shown. To determine the series, holes are drilled in the gage large enough to accommodate all drills in that particular series.

Ernest Jones
Bronx, N. Y.





Graduating Machine*

When producing a limited quantity of precision graduated dials of various sizes, the investment of a considerable amount of money for specialized graduating equipment is usually not warranted. A simple bench-mounted machine built largely from standard equipment can be used for graduating dials. A small universal dividing head is mounted on a welded steel base and acts as a means for holding and accurately spacing the work. A discarded lathe compound slide is fitted to a raised platform on the weldment. Secured to the compound is a lever-actuated key seating attachment. A sharp pointed cutting tool fitted into the key seater is used to cut graduations in the work. The lever actuated slide of the keyseater permits a rapid cutting action.

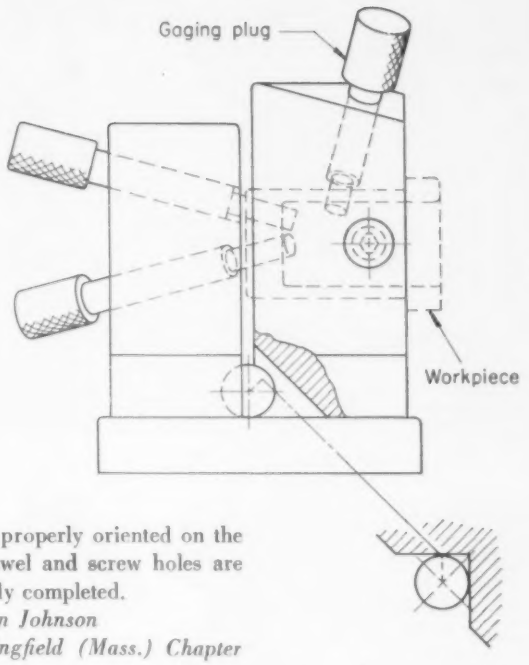
A spring-loaded rotary stop is located under rear end of the slide ram of the keyseater. Four adjustable stop screws are used to regulate the stroke of the ram for making graduations of various length on the dials. The rotary stop is seated in various positions by means of a spring-loaded ball detent. Once the gaging screws are set, it is only necessary to rotate the stop one position for each change of length on dial markings. Angular dials are worked by swiveling the dividing head to the required angle or by swiveling movement of both the dividing head and lathe compound to a sum of two separate angles. The lathe compound can also be used as a means of setting the depth of cut of the tool. Work can be held in various ways. A mandrel mounted in a collet is the usual method. Larger work can be chucked or held on a face lathe attached to the spindle nose of the dividing head.

H. J. Gerber
Member-at-Large
Stillwater, Okla.

***Gadgets Contest Entry**

Gadgets

Multipiece Gage



When several complex locations in a part must be inspected a gage is often made in two or more sections for feasibility and economy of construction. However, some of the potential saving is thus lost through difficulty of achieving a proper relationship of critical dimensions from one section of the gage to another. The gage illustrated not only provides a means for achieving proper relationships at assembly, but simplified construction as well, even though several angles, both compound and simple, are involved.

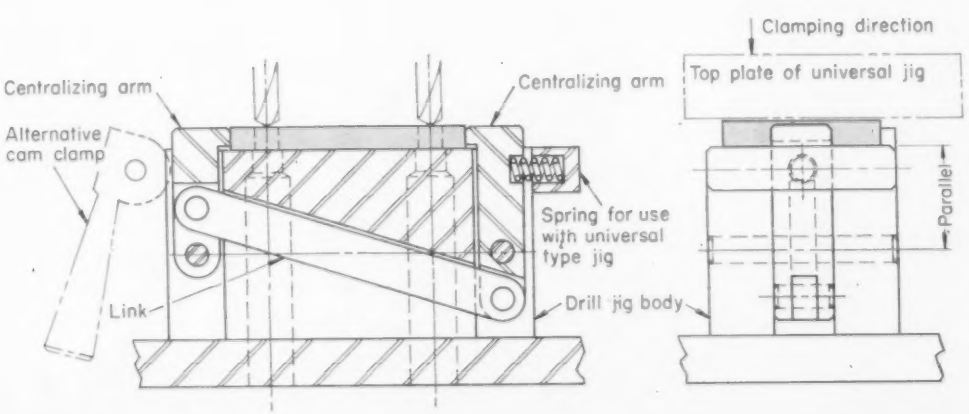
The gage is designed so that all critical gage construction dimensions are taken from a single ball. To make the gage, each section containing the gaging members is first machined with angular vee deep enough to provide points of tangency with the ball. All locations for gaging faces and components are related to the ball. Both sections are then properly oriented on the base plate with each vee bearing against the ball. Dowel and screw holes are transferred after which the ball is removed and assembly completed.

Allan Johnson
Springfield (Mass.) Chapter

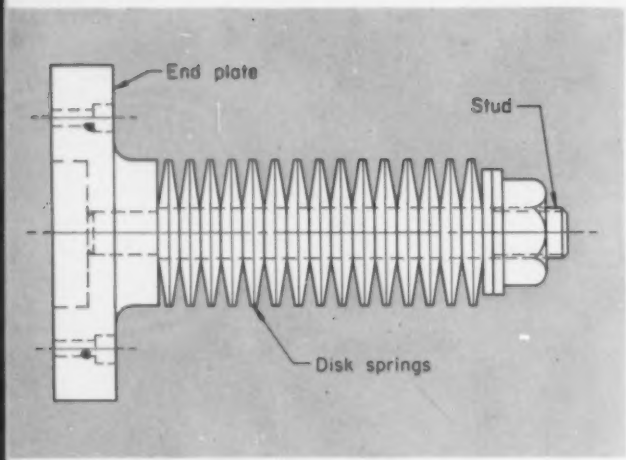
Centralizing Mechanism

Castings and sheared workpieces can be located for drilling quickly with the centralizing mechanism illustrated. Two dowels pass through the jig body and the centralizing arms. These dowels are located an equal distance from the locating surface of the jig body. Two short dowels pass through the link and centralizing arms only. The link length must be the same on both arms. A spring can be used to close the arms when the device is used with a universal jig which provides clamping pressure from the top. A lead-in then allows the part to be located upon insertion. If a universal jig is not used, the arms can be closed with a cam clamp as shown.

Kenneth Todd
Tonawanda, N. Y.



Gadgets



Expanding Mandrel

When workpieces must be machined that do not fit on a standard size expanding mandrel, a special one can be made by stacking Belleville washers or disk springs on a stud fitted with an end plate as shown. After assembly the OD of the springs is ground to the required size with the springs under slight compression. A collet for gripping a rod or bar can be constructed by stacking the springs inside a cylinder which has a cap on the end.

Thomas Baxter
Grand River Valley Chapter

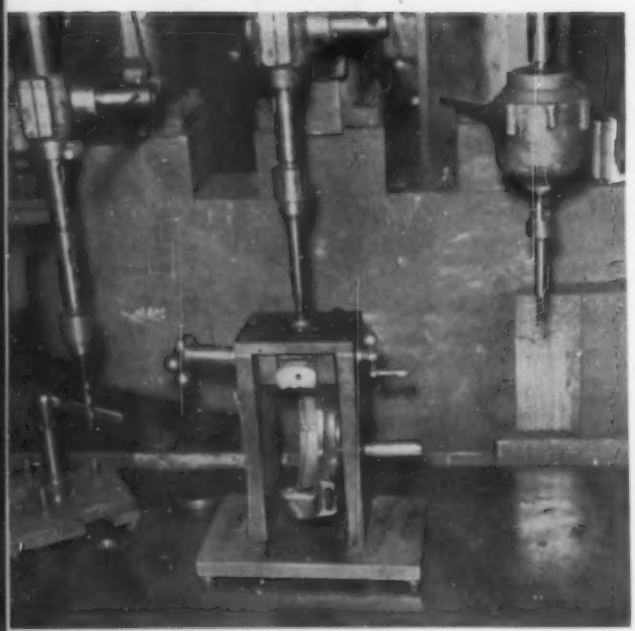


Photo courtesy of Rockwell Mfg. Co.

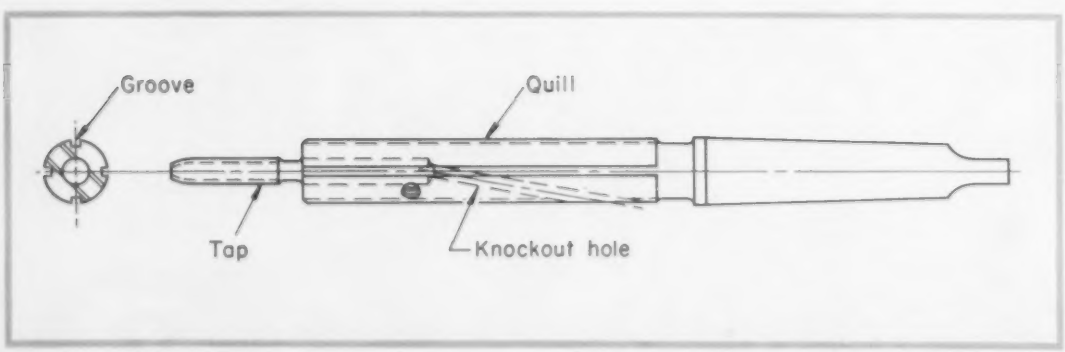
Drilling and Tapping Tools

Usual methods of tapping following drilling involve either removal of the part from the fixture, placing a hinge cover on the fixture, or using a slip removable drill bushing. The drill and tap quill illustrated is used as a means to drill and tap through the same bushing. By making quills for both drill and tap for each hole, the same diameter, and each pair of quills a different diameter, various sizes of holes can be tapped without error in one fixture.

Speed is increased because no time is lost removing the part from the jig, the jig from the part, or turning or tumbling the jig or removing a slip bushing in order to insert the tap. When tapping small holes with delicate taps, the quill can be used to align the jig.

A special effort should be made to keep the approach of the drill at an angle of 90 deg to the surface of the part. The distance of the bushing from the workpiece is given by the distance the drill extends from the drill quill.

David Pettigrew, Pittsburgh, Pa.



designed for
PRODUCTION

Spot Welder Prevents Discoloration

Spot welder, developed by Weldex Div. of The Metal Craft Co., Detroit, makes it possible to weld coated materials without discoloration or damage to the coating. Such operations have been performed before, but power requirements were greater and capacitor recovery was slow, usually two to three seconds.

Improved ability of the welder is due to the arrangement of the capacitors which provide 120 pulses of short duration current per second. These power pulses have a duration of one millisecond each, giving a rise time through the transformer of 500 to 600 cps. By using these short intervals, the weld transformer can handle much greater power than is possible with 60 cycle current.

Because of the short duration of the current pulse, heat generated in the weld zone is low. Greatest amount of generated heat is at the immediate weld surface and because of the short interval of pulse duration, heat cannot spread throughout the work.

SPOT WELDER being used to weld vinyl-clad steel. High temperature for short time interval permits welding without deterioration or discoloration of vinyl coating.

SPOT WELDED test strip ⅛-inch aluminum. Operation requires 1/10 the power used in conventional welders.

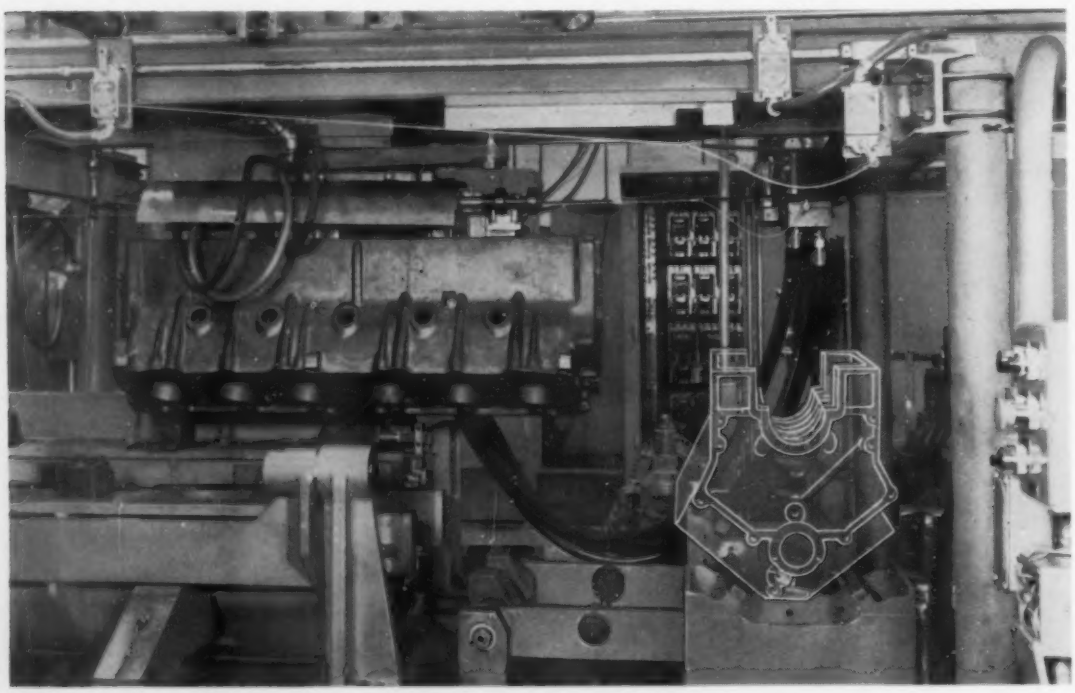
Machine Handles Different Size Workpieces

Integration of motor block design with transfer line design has enabled a truck manufacturer to install one automated transfer line for production of two different motor blocks—one a V-6 and the other a V-12. The V-12, produced in small quantities not justifying a separate transfer line, is designed as two V-6's cast together. Features common to both motor blocks include identical cross sections, hole patterns and cylinder head mountings.

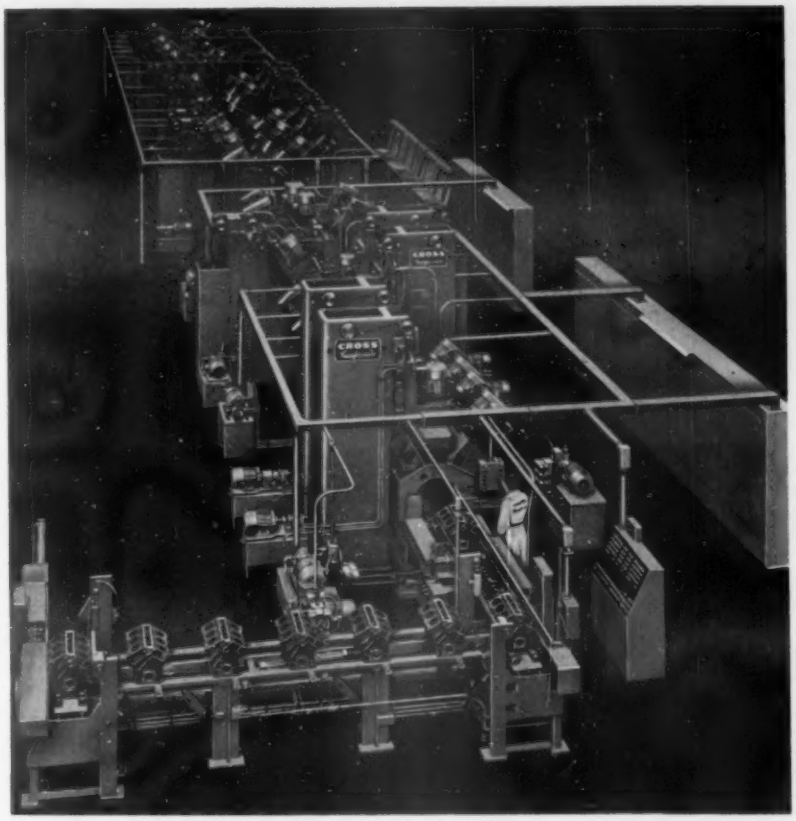
The transfer line, which performs boring, reaming, tapping, chamfering and spot-facing operations, consists of four separate sections with provisions for banking between sections. A 100-ft accumulating conveyor joining the sections enables the transfer line to maintain constant production during change-over from one block to another. Utilizing 82 stations, 25 of which are idle, the line is sufficiently versatile to accommodate future design changes in either motor block.

As blocks move through the line, V-6 block movements are conventional but V-12's require three variations of normal transfer line movement. In some cases the blocks index twice at one station to receive a double set of holes. At other stations blocks are shuttled to one side to receive offset holes or the head itself is shuttled. In cases of double stops at one station, economic factors preclude the use of a second head, since double cycle time is not prohibitive.

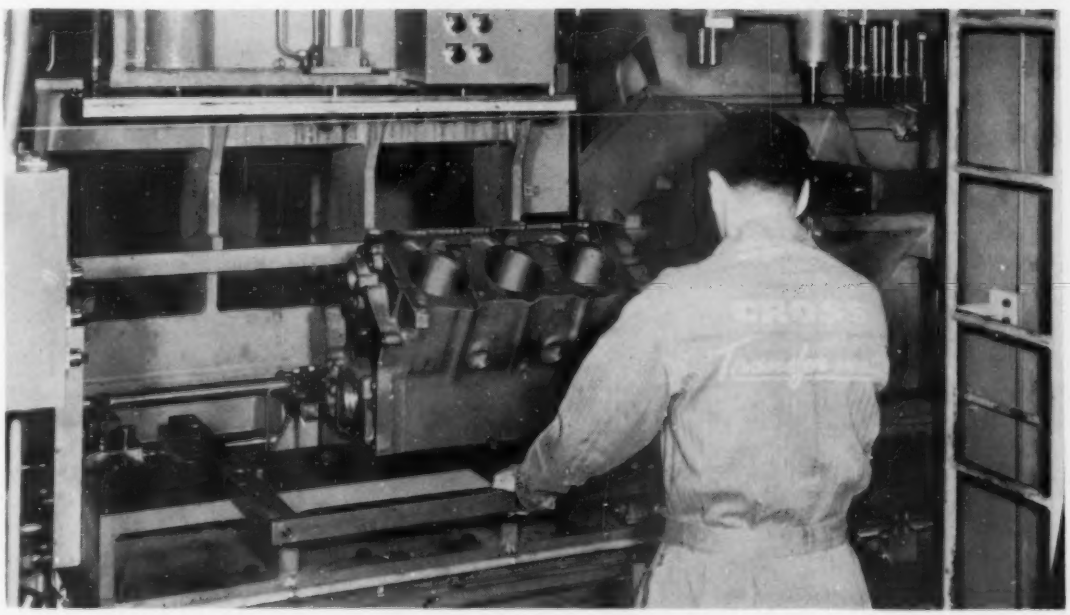
Productive capacity of the line, designed and produced by Cross Co. of Detroit, Mich., permits production of a V-6 block in 54 seconds and a V-12 in less than two minutes. Change-over of the line from one block to another can be accomplished in approximately four hours.



BLOCKS LEAVE THE FIRST SECTION, at right, and enter the second section of the transfer line by raising and rotating 90 deg.



TRANSFER LINE producing V-6 motor blocks. Using modular construction, the line is capable of producing either V-6 or V-12 units.



PROBE STATION for inspecting machined block. Defective parts are removed manually.

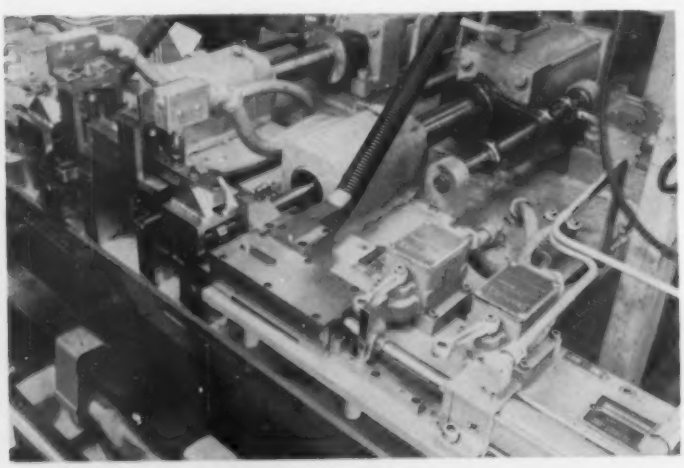
Assembly Operations Performed in Transfer Line

The natural advantages provided by building-block construction make assembly operations in transfer lines practical. An example of this is seen in a 76-station closed loop palletized transfer machine designed and built by Buhr Machine Tool Co. for the Saginaw Steering Gear Div. of General Motors.

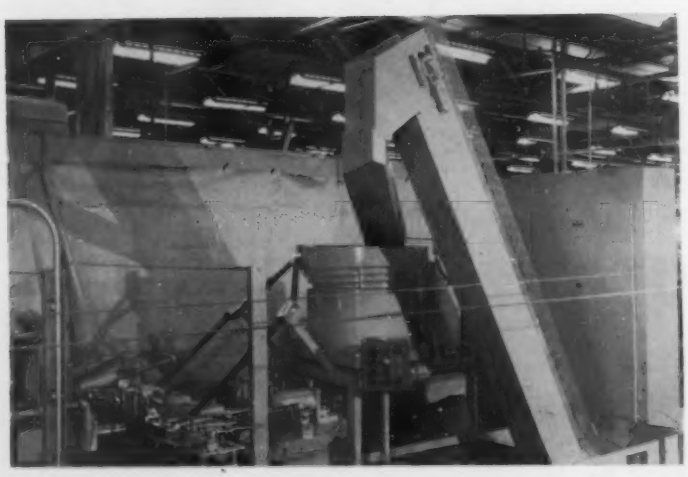
The assembly station presses bushings into steering gear pump housings. This operation enables a subsequent boring station to finish the inside diameters of the bushings to absolute concentricity with other diameters machined in the line.

In operation bushings are deposited in bulk quantities in a floor type feeder bin from which they are elevated to a vibratory-bowl feeder by a cleated conveyor. Tracks on the inside of the bowl present the bushings to a baffle by-pass at the top of the bowl. The by-pass splits the feed to two coil-spring tubes, the assembly operation being performed on two housings at a time. Bushings are shuttled from the lower end of each feed tube into orientation units where they are rotated until their oil grooves are in the correct assembly position. A five-inch cylinder then pushes the bushing home in the pump shaft hole.

Safety of operation in the assembly station is provided by electrically interlocked machine movements. No operation can be initiated until the previous one is finished.



AIR CYLINDER in foreground operates one shuttle mechanism. Twin cylinders, right rear perform assembly operation on housing.



ASSEMBLY STATION in transfer line. Hopper and conveyor (right) feed bushing to work area.

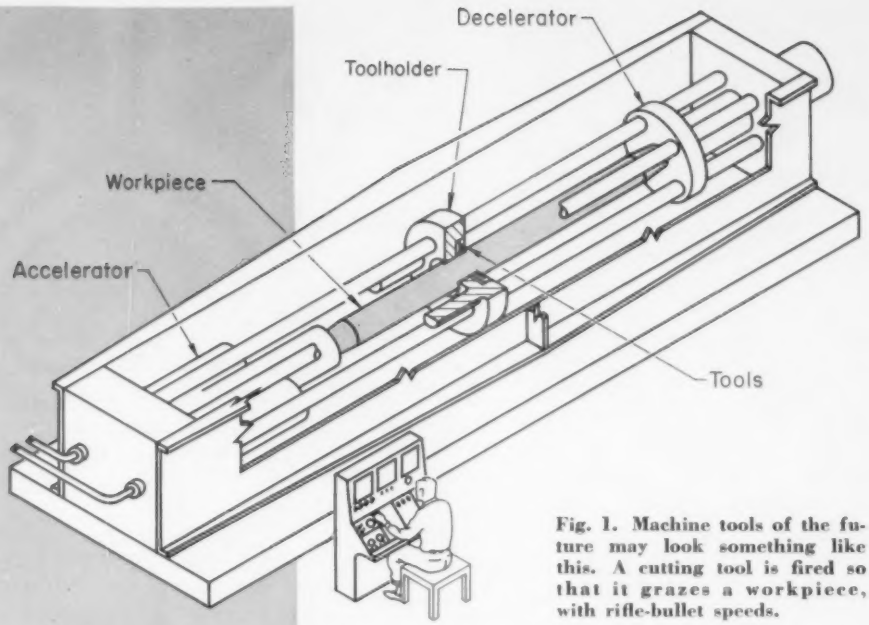


Fig. 1. Machine tools of the future may look something like this. A cutting tool is fired so that it grazes a workpiece, with rifle-bullet speeds.

recent developments in

ultrahigh-speed machining

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The articles on the following pages all deal with important developments in tool and manufacturing engineering — ultrahigh-speed machining, techniques for cutting Space-Age materials, metalcutting with plasma flames, new precision forming methods and the use of explosive energy for shaping metals. These articles are based on papers that will be presented at the ASTME Annual Meeting, where some 70 authors will discuss significant advances in the field of metalworking.

Abstracted from Paper 255, "Recent Developments in Ultrahigh-Speed Machining," to be presented at the 28th ASTME Annual Meeting. Copies of the complete paper may be purchased from Society Headquarters.

MISSILES AND HIGH-PERFORMANCE aircraft require alloys that can withstand high temperatures and retain strength at those temperatures. Alloys that meet these requirements are being found and used. Unfortunately, the very characteristics that make these alloys desirable Space-Age materials make them difficult to machine. Conventional machining processes and cutting tools can be used, but at a tremendous penalty in time and cost. The alternative is to develop processes that can cut Space-Age materials fast and efficiently. Experiments at Lockheed have proved that ultrahigh-speed machining of high-strength materials, one new process, solves cutting problems and can become a production reality in the future, *Figs.* 1 and 2.

Early Experiments: As early as 1950, military agencies and individual aircraft companies were investigating cutting variables as related to tool

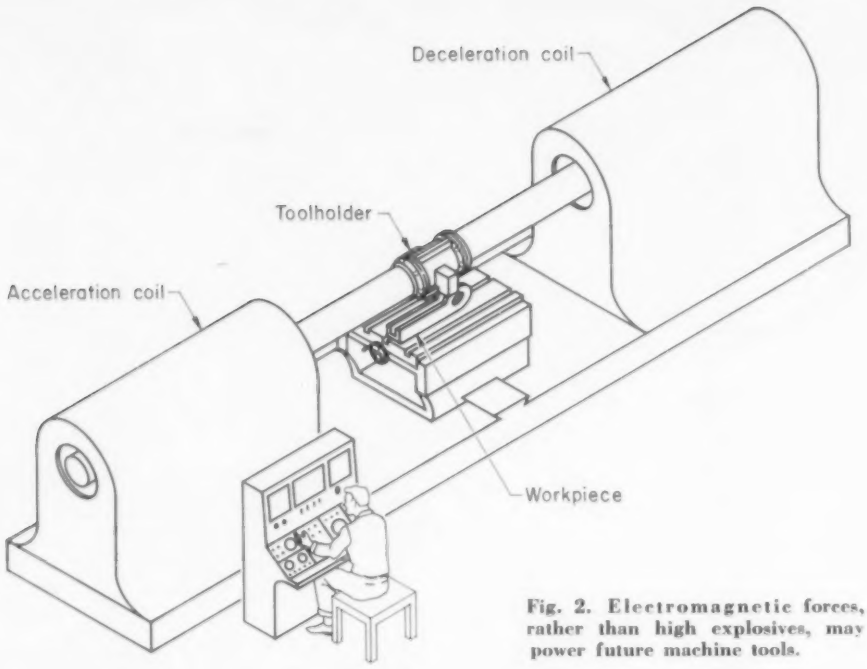

Fig. 2. Electromagnetic forces, rather than high explosives, may power future machine tools.

life on some of the newer materials. They were well aware of the problem facing the defense industries if machining speeds on parts and components suddenly shifted from a high of 15,000 fpm on nonferrous alloys to a low of from 20 to 300 fpm on high-strength ferrous and titanium alloys.

Lockheed investigations were based on the existing theory of plastic deformation of metals under high-impact loadings. This theory indicated that materials had critical impact velocities which, if passed, caused instantaneous failure under tension loading. It was concluded that by increasing machining speeds to or above these velocities, the normal relationships of workpiece material, tool material and geometry, and chip would be changed. Further, the increase in temperature and types of wear resulting from normal machining speeds and feeds would not occur. The results of this study were reported in an article published in THE TOOL ENGINEER, Oct. 1958, p. 71.

Experimental Method: Literature and patent searches disclosed little data relevant to phenomena of the magnitude encountered in ultrahigh-speed machining. Results of the search made it quite obvious that ultrahigh-speed machining would have to be proved out by actual experimentation.

To achieve the range of cutting velocities required for a thorough investigation in the most efficient and economical manner, a linear motion explosively actuated test apparatus was designed and built. It consisted of a 20-mm smooth-bore gun barrel, a special single-load breech, a muzzle fixture, a concrete gun mount and firing controls. The muzzle fixture (extension of the gun barrel) was designed to accept a single-point cutting tool in special interchangeable toolholders with provisions for measuring cutting velocities, forces, temperatures, vibrations and chip formations.

Workpieces were projectiles of special design, *Fig.* 3, and were propelled with standard 20 mm hand-loaded cartridges. By varying the type and weight of powder charge and the weight of the projectile workpiece it was possible to obtain any desired cutting speed from 15,000 to 250,000 fpm. A bunker filled with Celotex sheets was used to catch the workpieces for metallurgical testing.

Arrangements were made for chips to escape and be collected without mutilation for further metallurgical examination. Chip velocity was measured. Photographic coverage of chip formation was accomplished through a ½-inch-diameter hole in the fixture which provided a view of the tool cutting edge and the top section of the projectile workpiece. Pin contactors provided necessary electrical contacts for triggering recording instruments, which included an oscillograph to record temperatures, forces and system frequencies at a writing speed of 160 ips; two electronic counters to record projec-

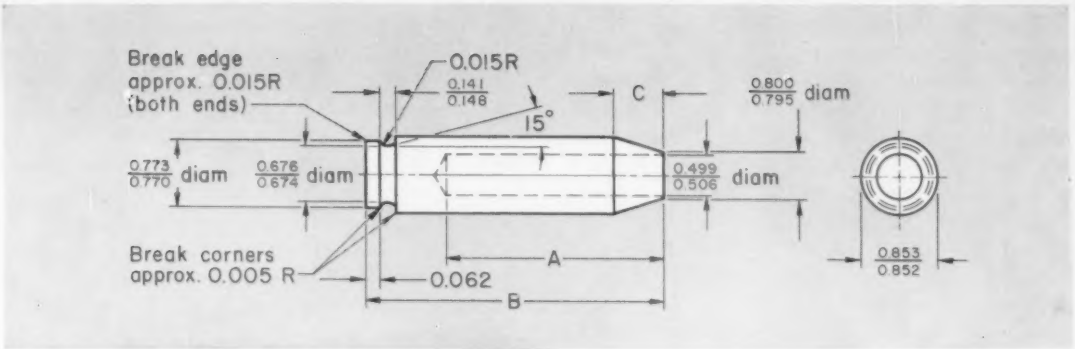

Fig. 3. Projectile (workpiece) for ultrahigh-speed machining tests. Dimension *A* ranged from 1.25 to 5.50 inches; dimension *B* from 1.75 to 12.00 inches; dimension *C* from 0.30 to 0.65 inch, depending on the specifications for individual experiments.

tile velocities before and during the cut to an accuracy of 0.1 microseconds; a time interval meter to record postcut velocities; and two oscilloscopes equipped with cameras to record cutting forces and system frequencies.

Two types of toolholders were used in the muzzle fixture. The rigid holder shown in *Fig.* 4 was designed to give the utmost support to the tool. Another holder was instrumented to record both the horizontal and vertical cutting forces in an orthogonal cutting force system. Strain gages applied in bridge networks were used to separately record the two components of force under investigation. *Fig.* 5 is a sketch of the toolholder-strain gage arrangement and *Fig.* 6 is a photo of the completed fixture. The natural frequency of the transducer, in both vertical and horizontal directions, was measured at approximately 4000 cps. The column compressional stiffness was calculated at 9,300,000 pounds per inch and the range of strain capacity at 50 to 17,000 pounds. Care taken in the design and fabrication of this transducer permitted linear calibrations that were low in hysteresis.

Tool temperature and temperature gradient readings were made by using iron-Constantan thermocouples on the toolbit. Two thermojunctions were formed by accurately spot-welding 0.001-inch-diameter Constantan wires to the toolbit end clearance angle. Electrical contact was made through toolholder contact screws.

Materials Tested: Five materials were tested during the program. Those were AISI 4340 steel, AM 350, Inconel "X," 6AI-4V titanium and 7075-T6 aluminum. All materials except the aluminum were tested in both the annealed and fully heat-treated conditions.

Most of the testing was conducted on AISI 4340 steel. Annealed 4340 was compared to heat-treated 4340 to establish the effect of material heat-treat condition on cutting velocity. The results obtained were used as data against which subsequent tests were planned and compared. The four remaining materials were tested at a velocity range (selected from the datum) that was considered optimum.

Cutting Tools: Cutting tools used during the data tests were $\frac{3}{8}$ and $\frac{1}{2}$-inch-square high-speed tool steel types of SAE T-8 composition. This tool material was selected because of its qualities of abrasion resistance, toughness and hot hardness as compared to other tool steels available in stock sizes. Cutting tool geometry was maintained at zero back rake angle and 5-deg end relief angle. For comparison purposes, a few tests were made in which the back rake angle was varied from +10 deg to −10 deg and the end relief angle was increased to 7 deg. Carbide and Stellite cutters were also used for comparison. In all cases, cutting tools were used only once, to establish a direct comparison of tool wear and metallurgical changes to cutting speed. Depths of cut varied from 0.005 to 0.045 inch during the series of tests.

Supersonic Sled: To extend data obtained by cutting at high speeds with the 20-mm gun apparatus, cuts four feet in length were made on the supersonic sled track at Edwards Air Force Base. Conditions of cutting were identical to those of the data test except that the cutter was engaged in a workpiece eight times as long.

For direct comparison of present-day cutting speeds with those obtained on the test apparatus at ultrahigh speeds, machine cuts were made on a conventional toolroom planer at speeds between 40 and 80 fpm. In this series of tests conditions of cutting were identical to those of the datum test at ultrahigh speeds except for cutting speed.

Results: The results of these experiments indicate the feasibility of ultrahigh-speed machining. No upper limit was found over the range of cutting velocities tested. Statistical analysis of data collected denote a cutting velocity of approximately 120,000 fpm to be best for the conditions tested.

Brittle or cleavage type metal failure did not occur during the tests on 4340 steel, although for steel in the heat-treated condition the amount of plastic deformation decreased markedly and the chips became small discrete particles. This was not the case with the other alloys investigated. With the other alloys, all chips produced were in the form of small discrete particles, and brittle type failure could be deduced. Generalization of metallurgical behavior is difficult due to the variety of behaviors exhibited by the five alloys investigated. It is emphasized that statements regarding alloys other than 4340 are made after only a minimum number of tests have been run.

Adiabatic Shear: The critical impact velocity suggested by theories of plastic wave propagation was not encountered and other mechanisms were sought to explain the observed behavior. The experimental results do suggest a mechanism to explain the observed metal separation behavior—adiabatic shear. As the velocity of machining increases, an adiabatic condition is approached in which thermal energy is restricted to preferred slip planes. Because of weakening in these preferred slip planes, additional slip occurs and complete shear results.

Although this mechanism applies to both annealed and heat-treated 4340 steel, comparison of the two heat-treat conditions emphasizes important dissimilarities in behavior. Annealed 4340 projectiles displayed work hardening of the machined surface and of the chips. Distortion of the chips was severe and only at very high velocities was transformation to martensite visible at the machined surface of the projectile and in the chip interface. In the heat-treated projectiles, formation of martensite occurred at all velocities of machining and was observed also at machined interfaces of projectiles and in shear planes of chips. Distortion of the microstructure appeared smaller in the heat-treated projectiles.

It was evident from examination that slip occurred in many shear planes in annealed 4340 and that thermal energy was localized in adjacent planes only at the highest velocities. In heat-treated 4340 steel, slip occurred in fewer planes and there was less plastic deformation. These observations seem consistent with the expected properties of 4340 steel. Work hardening is expected to occur in annealed 4340 and the process of slip transfers progressively to new shear planes. In the heat-treated steel, slip, once initiated in planes of maximum shear stress, continues because of localized thermal effects. Work hardening, then, does not occur in the heat-treated projectiles or chips.

Chips from annealed 4340 specimens showed no change in hardness within a machining speed range of 27,000 to 170,000 fpm, but over 170,000 fpm an increase due to phase transformation was observed. The heat-treated 4340 chip specimens showed little change over the complete velocity range studied (15,000 to 210,000 fpm). It was concluded from this that a condition does exist—over a wide range of cutting velocities—where the shearing force does not increase.

Chip Formation: Chip velocity was recorded to determine the cutting ratio (velocity of chip to velocity of cutting). This data allowed computation

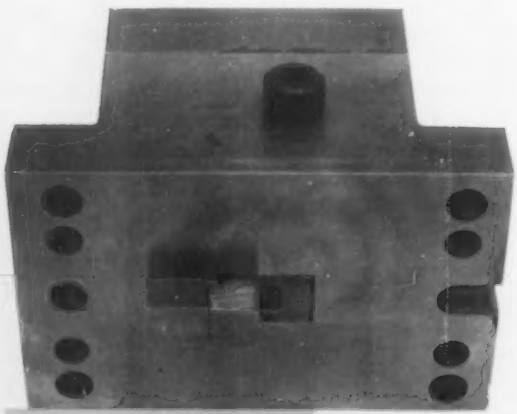

Fig. 4. Rigid toolholder assembly provides maximum support for tool.

Calculated Values of Shear Angle and Chip Compression Factor

Workpiece Material Tested	Depth of Cut (in.)	Cutting Velocity V (fps)	Chip Velocity V_c (fps)	Calculated Shear Angle ϕ (deg)	Calculated Chip Compression Factor λ
Annealed 4340	0.022	373	605	58.3	0.617
Annealed 4340	0.020	405	500	51.0	0.810
Annealed 4340	0.023	879	1282	55.6	0.685
Annealed 4340	0.023	894	1488	59.0	0.600
Annealed 4340	0.019	894	1120	51.3	0.800
Annealed 4340	0.021	1510	1562	46.1	0.965
Annealed Inconel "X"	0.028	1442	2400	59.0	0.602
Annealed Inconel "X"	0.025	1832	2082	48.7	0.880
Heat Treated Inconel "X"	0.024	1465	2190	56.3	0.670
Annealed AM 350	0.023	1480	2500	59.3	0.593
Annealed 6A1-4V Titanium	0.018	1875	1690	42.1	1.110

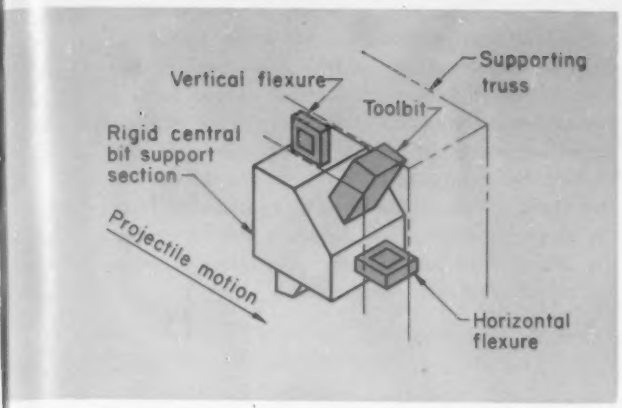

Fig. 5. Instrumented ½-inch tool bit holder. Strain gages mounted on flextures indicate column compression in both vertical and horizontal planes.

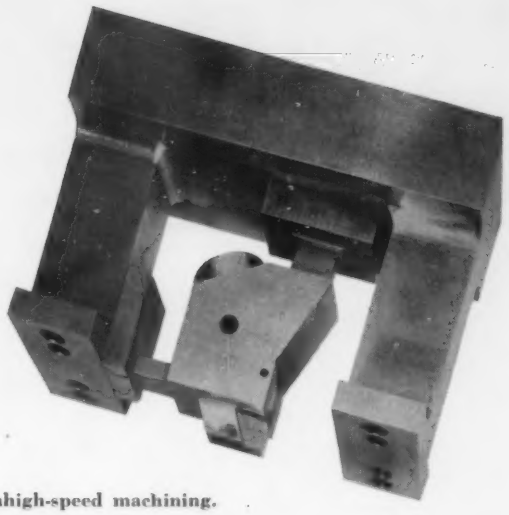

Fig. 6 (right) Completed fixture for ultrahigh-speed machining.

of the shear angle ϕ and the chip compression factor λ. Chip formation diagrams are shown in *Fig.* 7. Using the equation

$$\frac{V_c}{V} = \frac{\text{Sin } \phi}{\text{Cos } (\phi - \alpha)} = \frac{1}{\lambda}$$

for a rake angle α of zero degrees, it can be shown that $\phi = 45$ deg when the chip velocity V_c equals the cutting speed V and that for values of $V_c/V > 1$, $\phi > 45$ deg and for $V_c/V < 1$, $\phi < 45$ deg. Shear angles resulting from conventional machining operations have been shown to be between 15 and 33 deg. Typical results obtained during the tests are noted in the accompanying table.

The apparent increase in shear angle, ϕ, with high cutting speeds could provide the basis for a decrease in shear force required to machine at higher velocities. Increased shear angles of cutting lower the shear plane area, which in turn reduces the shearing force required. This condition is believed to be beneficial to efficient machining and therefore justifies continued and more detailed study in the future.

Analysis of Results: Measurements made on annealed 4340 steel indicated no appreciable difference between the horizontal and vertical forces throughout the velocity range tested. Both force components decreased approximately 50 percent as velocity increased from 90,000 to 120,000 fpm. Plotting average force versus cutting velocity, it was apparent that the vertical force, when cutting heat-treated 4340 steel, was approximately three times as large as when cutting annealed material, while the horizontal force remained about equal. Other plots indicated that the ratio of cutting force to area of cut (as well as tool wear per inch of cut) was less for deep cuts than for light cuts.

The results do not support an indefinite temperature rise theory. Excessive oxidation and gross melting did not occur and there was no evidence of heat discoloration on the machined surface. An attempt to find correlation between the temperature rise and other machining parameters was not particularly successful. The most significant conclusion drawn from the results was that the temperatures recorded were not excessively high. Even in heat-treated 4340 steel, which displayed the maximum temperature effects, no definite trend was discerned over the entire range of cutting velocities tested.

Maximum heat effect on cutting tools was limited to a superficial layer of approximately 0.0002-inch depth, with no noticeable increase with changes in cutting velocity. It can be concluded that the amount of heat generated does not increase in direct proportion to the cutting velocity. There is, however, no indication that temperature decreases at any particular velocity. The mechanism of adiabatic shear would tend to limit the increase in heat generated. By this mechanism, a finite rise in localized temperature does not require a substantial increase in total heat generated. Moreover, there is no evidence to support the theory that frictional forces between the tool, projectile and chip significantly add to cutting temperatures. The amount of heat that can be transferred to the cutting tool from a hot source at the tool chip interface in the extremely short cutting time is very small and can account for very little average temperature rise of the tool.

High system frequencies (up to 1.5 megacycles) were recorded during testing. These frequencies resulted in workpiece striations which were correlated, in part, to shear wave reflections traveling at an approximate speed of 804,000 fpm during machining. This wave is initiated during cutter workpiece impact and reflects at the free end of the

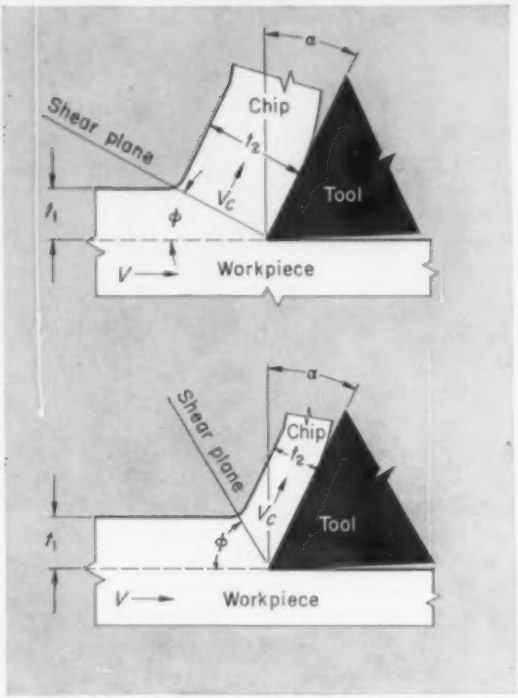

Fig. 7. Chip formation. At top, chip is thicker than stock removed and chip velocity is less than cutting speed. In drawing at bottom, opposite is true.

workpiece. The reflected wave then meets the cutter and a striation results. After several reflections the amplitude becomes small, probably due to dampening.

The relation of tool wear per gram of metal removed to cutting velocity indicates that minimum wear was encountered at a cutting velocity of 120,000 surface feet per minute. On heavy cuts tool wear was about the same when machining heat-treated or annealed materials. Effective tool wear —the distance between the crater top and the straight edge along the tool's cutting edge with the tool in the normal cutting position—was used as a criterion of tool wear since it took into consideration both the face and flank wear. Plots of flank wear or face wear versus cutting velocity showed identical trends. Tool bit flank wear was generally greater after machining heat-treated 4340 steel and face wear was greater after machining annealed 4340 steel. Effective wear was dependent only on cut velocity and depth of cut. Based on limited tests, tool grind geometry appeared to have little effect on cutter or machining performance; cutting velocity was the chief factor. The Stellite and carbide cutters tested appeared to offer less resistance to impact loading than did the SAE T-8 high-speed tool. The difference in tool wear between heat-treated 4340 machined at conventional speeds and at very high speeds is significant—a 5000 to 1 increase in machining speeds resulted in equal or less wear on the toolbit in most cases.

No tool wear was encountered when machining 7075-T6 aluminum at 120,000 fpm. Surface finishes obtained on the cut surfaces ranged from a low of 3 to a maximum of 99 microinches with no significant variation due to cutting speed. Results of long cuts (four feet) made on the supersonic sled track compare closely to those obtained from the projectile tests, which indicates that increasing the cutting time on the tool by a factor of eight has no effect on the results.

Future Applications: Tomorrow's machine tools, designed for ultrahigh-velocity machining, may look like those in *Figs.* 1 and 2. When centrifugal forces in the type of envelope required for adequately supporting rotating spindles and cutters are considered, obtaining rotary motion will be much more of a problem than achieving the velocities contemplated through linear motions. Sharp contours and pockets present problems. Once it is illustrated that a certain mode or type of cutting lends itself best to ultrahigh-speed machining, the details of specialized cuts would have to be worked out. It is within the realm of possibility that contours will be generated by incremental cutting.

Vibrations will have to be controlled. Materials are already available—and more are being developed—which exhibit high damping characteristics. It is considered feasible to use air bearings or electromagnetic fields to support high-speed spindles. High-horsepower d-c motors without commutators or sliprings have possibilities. Jet turbines may be considered as prime movers. These could be equipped with flywheels to gain the inertia effects required for machining. New types of drives and spindles will be considered.

The machines shown in *Figs.* 1 and 2 could utilize electromagnetic forces, explosives, pneumatics or hydraulics for actuation of a high-speed shaper or broach with the tool or workpiece held stationary. An indexing device might be used to position the workpiece or cutter during or between cuts to generate contours. Air cushions or electromagnetic or mechanical brakes could be used to stop the forward progress of the tool.

The excellent surface finish and reduction of cutter wear at increased cutting speeds point to the fact that there is much to be gained by the vigorous pursuit of basic data and experience pertaining to ultrahigh-speed machining. Although extrapolation of data from one alloy to another is impossible at this time, that fact does not preclude utilization of the process. The over-all results of the study make it readily apparent that further research should be pursued. The data obtained should be further developed, formulated, refined and applied to the design of a new generation of machine tools for the coming Space Age.

DRILLING

high-strength materials

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Tool life is critical in drilling high-strength material and can be improved remarkably by proper choice of drill design and cutting conditions. A series of extensive tests has been run to provide a general guide for drilling both extremely hard materials and thermal resistant materials.

Abstracted from Paper 258, to be presented at the 28th ASTME Annual Meeting. Copies of the complete paper will be available from Society Headquarters.

*Senior member ASTME Cleveland chapter.

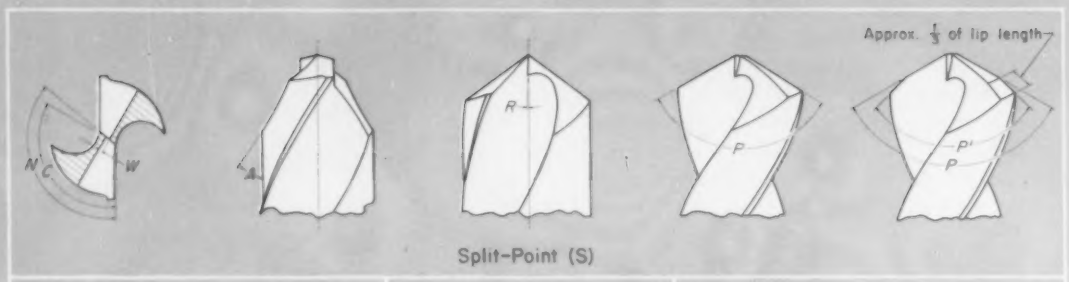
NEW MATERIALS, brought into use by the advent of the jet and missile age, cause new machining problems. To help tool and manufacturing engineers meet such problems, extensive drilling tests were conducted to develop useful information.

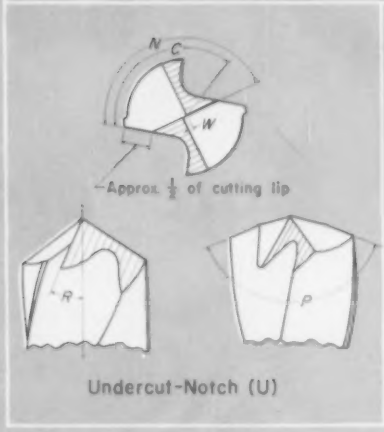
For the testing, it was decided to use the criterion of drill breakdown for evaluation, rather than thrust or wear land considerations. This makes comparisons of the different types of drills more realistic. Thus, the high-speed steel drills were run to complete breakdown, and carbide drills were run until chipping or breakage occurred. In actual production, carbide-tipped drills should be used to 75 percent of the values shown, or less. Drill life data indicated in the tables are the average of several tests.

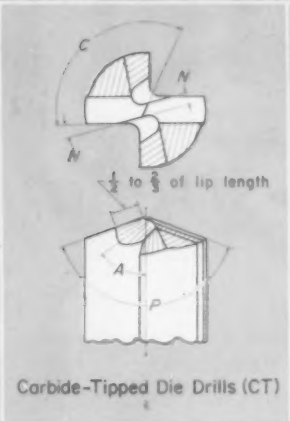
Most of the tests are based on a 0.250-inch drill cutting a 0.5-inch through hole. Except where coolant was the variable being examined, all tests of high speed steel drills were run using sulfochlorinated active cutting oil, while carbide tipped drills were run with soluble oil. Drill designs, point angles and styles of notching or web-thinning were investigated. Drill points used in the tests are identified in the Nomenclature. The effects of different coolants, of different types of high-speed steels, and of varying speeds and feeds are among the other variables studied and reported in the tables.

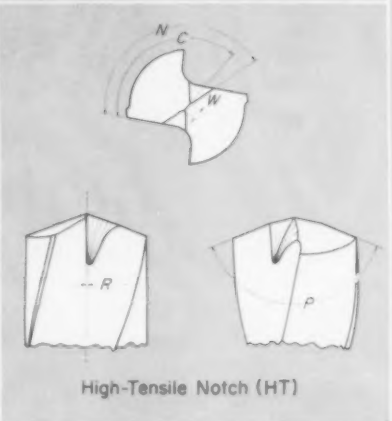
Drilling Udimet 700: As shown in TABLE 1, the 3300 series aircraft drill proved superior in one brief series of tests. In other tests, the low helix drill gave satisfactory results. The low drill life obtained with each of the three styles indicates the difficulty

Nomenclature of Drills Tested









Point Geometry Terms

- **A** = Angle of notch with respect to drill axis, deg
- **C** = Chisel edge angle, deg
- **N** = Secondary cutting edge angle, deg
- **P** = Included point angle, deg
- **R** = Notch rake angle, deg
- **W** = Web thickness at point after notching, inches

with which this material is drilled. Of the variables tested, feed and speed cause great change in drill life, as do changes in the condition of the material. Best machinability was obtained with a solution treatment of 2150 F followed by aging at 1950 to 1925 F. Altering other variables caused no significant improvement. Even with the carbide-tipped drills, the lowest feed and speed gave the best life.

Drilling René 41: The results shown in TABLE 2 indicate that drill strength and rigidity are highly important factors. The low-helix heavy-duty drill outperformed other drill designs. Short flute length increases rigidity and improves life. Because the high thrust loads encountered in drilling this material mean high axial loads that can prove damaging to the chisel edge, proper support in this area is required. Drill life increases as the included point angle is increased from 90 to 135 deg—the flatter point angle provides maximum support in this area is required. Drill life increases as the

Table 1—Drill Life Test Results in Udimet 700

Hardness (R_C)	Type of Drill*	Drill Material	Type of Point†	Point Ang'e (deg)	Drill Speed (fpm)	Drill Feed (ipr)	Number of holes drilled
40	LH	M-33	S	135	20	0.001	6
	3300						10
	C						2
40	LH	M-33	S	135	20	0.001	6
				118			8
				90			10
				90x118			8
40	LH	M-33	HT	135	20	0.0006	11
						0.001	8
						0.0015	3
					30	0.0006	<1
						0.001	<1
						0.0015	<1
40	CT		N	118	20	0.0006	22
						0.001	13
						0.002	<1
					60	0.0006	5
						0.001	8
						0.002	1.5
					90	0.001	9
37[1]	LH	M-33	HT	135	20	0.0006	2
						0.001	2
37[2]	LH	M-33	HT	135	20	0.0006	22
						0.001	12.5
38[3]	LH	M-33	S	135	13	0.0006	9
36[4]	LH	M-33	S	135	13	0.0006	26
						0.00126	31

*LH = Low helix drill; 3300 = Series 3300 aircraft drill; C = Series C aircraft drill; CT = Carbide tipped die drill.
†S = Split point; HT = High tensile notch; N = Notch thinned.
(1) Solution treated at 2150 F. No aging.
(2) Solution treated at 2150 F. Aged at 1925 F for 16 hrs.
(3) Solution treated at 2150 F. No Aging.
(4) Solution treated at 2150 F. Aged at 1950 F for 4 hrs.

Table 2—Drill Life Test Results in René 41

Hardness (R_C)	Type of Drill*	Drill Material	Type of Point†	Point Angle (deg)	Drill Speed (fpm)	Drill Feed (ipr)	Number of holes drilled
42	LH 3300 C	M-33	S	135	10	0.001	93 6 2
42	LH	M-33	S	135 118 90 90x118	10	0.001	93 26 13 11
42	LH	M-33	S S U HT	135	10	0.001	25(1) 93(2) 62(3) 110(4)
42	LH	M-33	S	135	10	0.001	93(5) 3(6)
42	LH	M-33	S	135	10	0.0006 0.001 0.002 0.003	95 93 14 6
42	LH	M-33	S	135	15	0.001 0.002 0.003	46 8 3
42	LH	M-33	S	135	10	0.001	93(7) 18(8) 3(9)

*LH = Low helix drill; 3300 = Series 3300 aircraft drill; C = Series C aircraft drill. Data are based on 0.1285-inch diameter drill.
†S = Split point; U = Undercut notch; HT = High tensile notch.
(1) Drill point web was notched to center.
(2) Drill point web was notched to 0.008 inch.
(3) Drill point web was notched to 0.008 inch.
(4) Drill point web was notched to 0.015 inch.
(5) Drill with 1-inch flute length was used.
(6) Drill with 1.625-inch flute length was used.
(7) Coolant used was sulfo-chlorinated active oil.
(8) Coolant used was chlorinated active oil.
(9) Coolant used was soluble emulsion.

included point angle is increased from 90 to 135 deg —the flatter point angle provides maximum support in the critical area of the chisel edge. Notch web thinning at the drill point reduces cutting forces by reducing the extruding effects of the chisel edge, but notching to center weakens the point and gives comparatively poor performance. The lowest speed and feed gave best drill life in this material. Also, the abrasiveness and tendency of the chips to weld to the tool requires the use of a copious supply of coolant with good lubricating and antiweld characteristics. Marked performance improvement is obtained using sulfo-chlorinated active cutting oil.

Drilling SAE 4340: For both R_C 45 and R_C 52, the more acute point angle, 90x118-deg gave the best drill life on high-speed drills, as shown in TABLE 3. In harder material, treated to R_C 55, using carbide-tipped die drills, the opposite was true. The 140-deg included angle point gave longer drill life than a 118-deg angle. This is attributed to the fact that the carbide tends to crush at the chisel edge and the 140-deg point gives better chisel edge strength. The feed and speed survey with high-speed drills shows that low feeds give best drill life. Speed seems less critical in R_C 45 than in R_C 52. The effect of high speed steel grades seems less significant than design features such as flute length, web style and point

Table 3—Drill Life Test Results in SAE 4340

Hardness (R_C)	Type of Drill*	Drill Material	Type of Point†	Point Angle (deg)	Drill Speed (fpm)	Drill Feed (ipr)	Number of holes drilled
45	C	M-7	S	135 118 90x118	40	0.003	146 214 492
45	C	M-7	S	135	20	0.001 0.003	500+ 245
					40	0.001 0.003	500+ 146
					60	0.001 0.003	500+ 25
52	C	M-33	S	135 118 90x118	30	0.001	86 133 248
52	C	M-7	S	135	20	0.0006 0.001 0.003	175 29 3
					30	0.0006 0.001 0.003	80 17 4
					40	0.0006 0.001 0.003	33 11 5
52	LH	M-33 T-15 M-3	HT	135	30	0.0006	204 106 94
55	CT			140 118 140	90	0.001	90 67
					70	0.001 0.0015	83 48
					90	0.001 0.0015	90 73
					100	0.001 0.0015	73 50

*C = Series C aircraft drill; LH = Low helix drill; CT = Carbide tipped.
†S = Split point drill; HT = High tensile notch.

Table 4—Drill Life Test Results in Thermold J

Hardness (R_C)	Type of Drill*	Drill Material	Type of Point†	Point Angle (deg)	Drill Speed (fpm)	Drill Feed (ipr)	Number of holes drilled
38	LH RH C	M-7	N	135	50	0.005	10 21 432
50	LH RH C	M-33	N	135	20	0.0035	233 122 65
50	LH	M-33	HT	135	20	0.001 0.0035 0.005	43 233 159
					30 40	0.0035 0.0035	26 5
50(3)	LH	M-33 T-15 M-3 M-7 M-1	HT	135	20	0.0035	233 227 220 202 192
50	LH	M-33	HT	135	20	0.0035	233(1) 84(2)
57	CT			118 140	90	0.001	89 138

*LH = Low helix drill; RH = Regular helix drill; C = Series C aircraft drill; CT = Carbide tipped die drill.
†N = Notched point; HT = High tensile notch.
(1) Coolant used was sulfo-chlorinated active oil.
(2) Coolant used was soluble oil emulsion.
(3) With identical conditions except different heat, the number of holes drilled was 414, 309, 257, 247, 222.

angle. With carbide-tipped drills, best results were obtained at a speed of 90 fpm and a feed of 0.001 ipr. In other tests with carbide-tipped drills (results not shown), a feed of 0.0005 ipr developed higher thrust than a feed of 0.001 ipr. Apparently when the feed is too light a rubbing action occurs, rather than a clean cutting action.

Drilling Hot-Work Die Steel: Thermold J was chosen as representative of this general class of materials and the testing results are shown in TABLE 4. The effect of mechanical construction of the drills is very marked in this series of tests. In R_C 38 material, a reasonably heavy penetration rate is possible, and under these conditions the type C aircraft drill, with more chip room, is better able to produce and dispose of chips than are either of the heavy-duty styles. In R_C 50 hot-work die steel, cobalt-grade (M-33) high-speed steel drills were used. Here, the greater rigidity and cutting edge strength of the low helix heavy-duty design outperforms other drill styles. Drill life appears to be sensitive to feed and speed changes. Changing to drills of high vanadium or cobalt-grade steel improved life by about 50 percent, a less significant change than the 40 to 1 change caused by difference in drill type. But the effect of tool material cannot be revealed by a single series of tests. Many tests by different observers are needed to establish relative performance of different grades of tool material. Active cutting oil containing sulfur and chlorine increases drill life over that obtained with a simple water-soluble oil.

In this material, at hardness levels of R_C 54 and higher, the use of high-speed steel drills, even of cobalt grades, is not advisable. However, it is possible to use carbide-tipped die drills in this material hardened to at least R_C 57. The 140-deg point performed about 50 percent better than the 118-deg point. Drills were run until chipping or breakage occurred and the life recorded is thus at least 25 percent higher than good production drilling practice.

Conclusions

Testing will continue to obtain more complete results and to study the effects of more variables. However, the results already obtained are a good guide for drilling in hard materials under the conditions explored in these tests. In general, best drill life is obtained by selecting the most suitable drill design and point style, by minimizing flute length and by using slow penetration rates.

Improving Production Drilling Performance

IN PRODUCTION DRILLING, achieving the desirable objectives of long tool life per grind, minimum drill breakage, accurate hole location and size is often made difficult by the characteristics of twist drills themselves—low torsional strength of long twist drills, chatter, bending due to too much feed and deflection when the drill starts to cut. These adverse characteristics can be minimized considerably by holding the drill in a stubbed-up manner, according to analyses made by Scully-Jones and Co.

Three main forces affect the drill: (1) axial thrust used for feeding; (2) radial force or torque for turning the drill; and (3) side thrust. Axial thrust causes two kinds of metal-removing action. At the very center of the chisel point metal is extruded by axial force. At about the OD of the web thickness, the lips of the drill remove metal by a cutting action. Thus, in starting a hole, the chisel point has a tendency to wander, developing radial and side thrust deflection. Torque, applied to a two-fluted twist drill causes torsional vibration because the drill itself acts like a torsion spring. This fundamental lack of rigidity contributes to chattering, the greatest hindrance to long tool life. Side thrust occurs from drill grinding irregularities, rough surface, spindle runout, or when the two cutting edges of a drill do not cut evenly. Increasing drill rigidity improves drill reaction to these three forces.

A bushing helps reduce side thrust and increase rigidity as the drill starts to cut, especially when drilling very hard materials. But spindle and drill eccentricities cause a misalignment of the drill and bushing which results in margin wear. Side thrust also wears the drill margin. Some inaccuracies in hole location and size can be allowed by the bushing because of back taper on the drill, short support area of the drill in the bushing and spindle runout.

Stub drilling increases rigidity and can eliminate the need for bushings, especially for the high percentage of holes that do not require close tolerances, such as holes to be reamed or tapped, bolt clearance holes, and oil passage holes. For more precise holes, accurate location of the spindle can be coupled with stub drills to improve accuracy. The stub drill has increased rigidity, thus less deflection due to side thrust, which improves accuracy. Using the stub to lessen the torsion spring length makes the drill less susceptible to torsional vibration, or chatter. In some tests, as much as 8000 percent improvement was realized by decreasing drill projection.

In sum, holding the drill in a stubbed-up manner increases rigidity and thereby increases both tool life and the accuracy of hole location and size. Stub drilling also enables quick tool changes.

PLASMA FLAME speeds metalworking

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Fig. 1. Metallizing with fused tungsten. Gas delivers metal powder to torch forcing it into plasma stream.

Used for metalcutting and metallizing, the plasma flame may become useful for turning and for drilling hard-to-machine materials. The author discusses the theory of temperature generation in gas arcs and their application to industry.

Abstracted from Paper 288 "Plasma-Arc Speeds Many Metalworking Processes" to be presented at the 28th ASTME Annual Meeting. Copies of the complete paper will be available for purchase from Society Headquarters.

FLAME TEMPERATURES as high as 40,000F are created by heating a gas with an electric arc. Called "plasma flame," it is anticipated that these flames will establish many new processes in addition to several industrial applications presently in use. Extreme temperature, total atmospheric control, and low operating costs make this new device an important step forward in high-temperature technology. Current important applications include flame cutting and metallizing, *Fig.* 1.

Plasma technology is not new. Prior to World War II, arc techniques were developed in Germany for the production of acetylene. Large installations were constructed and are in use today. This use of the electric arc provides for the passage of the

arc and a gas through a tube. Natural gas at elevated temperature is transformed into various complex compounds which, if rapidly quenched to atmospheric temperature by a water spray, keep their identity. One such compound is acetylene.

This early development produces an outlet gas temperature well below 3,000 C. However, such early work provided the basis for the more modern designs which produce temperatures an order of magnitude greater.

Theory of Plasma Formation: The term plasma refers to a state of matter where the atoms are torn apart to form electrons and ions. The welding arc, as commonly used in the open atmosphere, produces a plasma gas. Air molecules are first dissociated and then ionized by collisions with the electron flow within the arc. Such open-arc plasma temperatures are relatively low (10,000 F) due to the relative freedom for the heated air to expand laterally.

By constricting the arc current to a small cross-sectional area, the plasma temperature may be increased greatly. For example, *Fig.* 2 compares the arc diameter of an open arc with a typical constricted arc. Assuming the same current flow, it is seen that the current density is significantly increased. A small flow of gas is provided to separate the arc column from the metal nozzle walls. Much of this gas is heated by the arc to temperatures greatly in excess of that possible in open arc operation. Due to such constriction each gas molecule is subject to many more collisions with the high energy electrons.

The constricted arc of *Fig.* 2 is one of two common arc configurations. In this case, where the arc impinges on an exterior electrode, it is termed a "transferred-arc". As shown, the nozzle portion of the torch is subject only to the intense radiation of the arc column. Extremely high current densities may be used in this configuration mode, with calculated gas temperatures as high as 60,000 F.

Conversion Efficiency of Gases

Gas Type	Voltage (v)	Conversion Efficiency %
Argon	35	50
Nitrogen	60	60
Hydrogen	110	75

The transferred arc is a useful tool only in those applications where an exterior electrode is available. It is the type of arc used for metalcutting, where the workpiece is the electrical anode.

The nontransferred arc is also shown in *Fig.* 2. In this case the arc is contained within the device itself. The gas is heated to plasma temperatures and issues at high velocity from the nozzle. Such a plasma stream is electrically neutral and is the true "plasma flame". As no exterior electrode is required, this flame may be used for any application where conventional oxy-fuel flames are applicable.

The design of the nontransferred-arc torch is complicated by the fact that the nozzle is the anode. It is thus subjected to anode heating by the impinging electrons. It is important that the arc be distributed over a relatively large area of the anode rather than on a single spot which would soon melt.

To allow for broad impingement of the arc electrons over the anode surface it is necessary that the arc length be relatively long. A short arc tends to strike the anode over a small area. The long arc, during its passage down the nozzle tube, becomes more diffuse; thus the electrons are distributed widely over the anode surface.

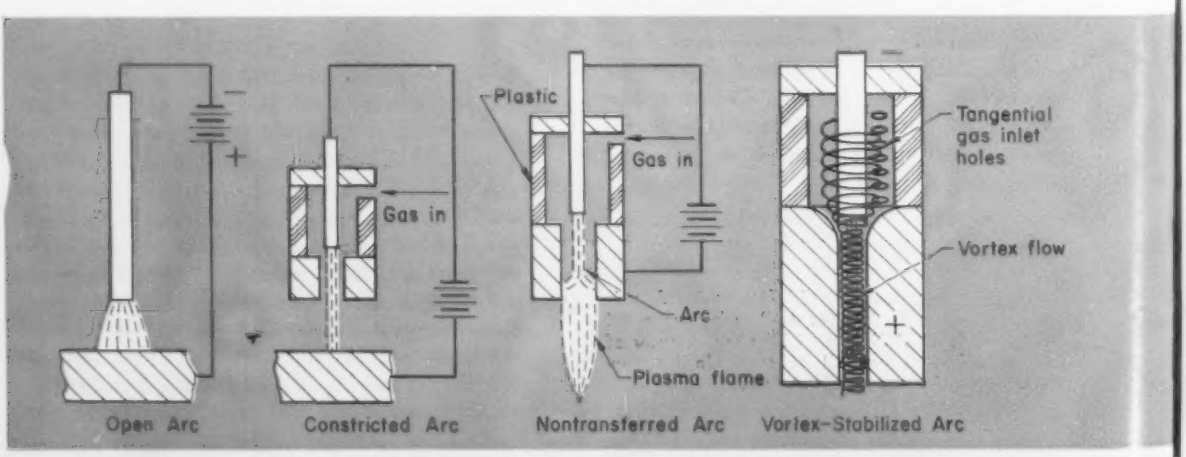

Fig. 2. Features of open arc, constricted arc, nontransferred arc, and vortex-stabilized arc.

Three techniques are available for positioning the arc centrally within the anode passage. The first two (the most common) utilize aerodynamic means for such positioning, while the third guides the arc by a magnetic field. *Fig.* 2 also shows a sketch of a "vortex-stabilized" arc. A free-vortex contains a core of relatively low pressure gas. As arc voltages are less at lower pressures, the arc prefers to pass through this axially positioned core. The core gas becomes heated and the arc column tends to spread. A point is reached where the electrons approach sufficiently close to the anode surface to impinge.

Extremely long arcs are possible depending on the vortex strength and the amperage levels used. Arc lengths as great as 3 feet are utilized in the device previously mentioned for the manufacture of acetylene. Shorter lengths are, of course, possible depending on the power level used. Shorter nozzle lengths may be used where arc extension beyond the end of the nozzle is not objectionable. In this case the arc extends out into the open atmosphere and then bends backwards through an 180-deg arc to impinge against the outer face of the nozzle.

The basic disadvantage of long nozzle length of the vortex torch is overcome by a technique of arc stabilization known as "gas sheath" arc positioning. Gas flow is maintained axially through the nozzle passage with a velocity profile ranging from a minimum value at the centerline to maximum value near the walls. The arc column is positioned along the passage centerline by the action of the higher gas momentum along the walls.

Use of electric energy in place of the chemical energy of an oxy-fuel flame allows extreme gas temperatures to be created. Whereas a chemical flame is temperature limited by its own heat reaction, there is no such limit when an outside source of energy is used. The chemical flame is usually limited to a peak temperature slightly above that at which dissociation effects commence.

Specific heat content of the gas as a function of temperature is shown in *Fig.* 3. Typical monatomic and diatomic gases are shown, argon and nitrogen respectively. It is to be noted that the monatomic gas has a nearly linear increase of temperature with heat addition until ionization begins. (At this point large amounts of heat are required to raise the temperature further.) At about 5,000 F the diatomic molecule begins to dissociate. The closely bound atoms are torn apart, each free to follow an independent path. Large quantities of heat are involved. Point A in the graph is the limit of the oxy-fuel flame. At about 10,000 F dissociation is essentially completed. Further heating of the dissociated atoms occurs and later ionization effects become important.

For most applications it is desirable to use the diatomic gases. Not only are they less expensive, but much larger heat content is available at lower temperature levels. Nitrogen plasmas at 12,000 F often fuse materials where argon at 30,000 F has more difficulty. Where a truly inert gas is required, a noble gas must be used.

An additional advantage of the diatomic gases is their higher arc voltage characteristics. The accompanying table lists voltages against gas type for normal gas—sheath torch operation. It is apparent from this table that the higher the voltage, the higher the efficiency.

In other words, the transformation of electrical energy to heat energy is more efficient the higher the voltage characteristic of the arc. (Further increase of efficiency is provided by vortex action which lengthens the arc, raising the operating voltage.) *Fig.* 4 shows the importance of the arc voltage on gas heating. Curve *a b c d* is drawn to represent hydrogen use. The region *a b* represents the cathode drop which is essentially a constant value in all cases. The region *c d* is the anode drop, again a constant value. The greater the voltage drop *b c*, the greater the gas heating. This region is referred to as the plasma drop.

Assuming the same cathode and anode drops for nitrogen and argon, it is apparent that the remaining plasma drops must be less than for hydrogen. The arc length in each case is assumed the same. The voltage gradient is thus a basic parameter in torch operation.

Applications: The plasma flame represents a much greater step upward on the temperature scale over the oxy-acetylene flame, than the development of the latter did over the air-fuel Bunsen flame in the early part of this century. It took many years to develop processes using the higher temperature of the oxyacetylene flame. Such is not the present case. The demand for high-temperature heat sources has spurred the development of the plasma flame device. Its availability is rapidly leading to new processes and applications.

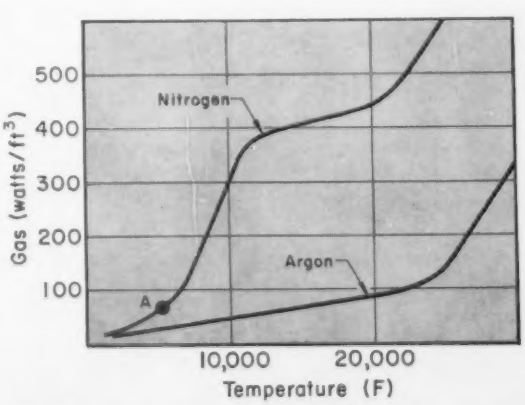

Fig. 3. Specific heat content of argon and nitrogen.

Metalcutting makes use of the transferred arc principle. The heating action is much like oxygen cutting, except electron bombardment and plasma heating are substituted for the iron-oxygen chemical reaction.

Speed of oxygen cutting is diffusion limited. That is, time must be provided for the oxygen molecules to diffuse from the cutting oxygen stream to the reaction surface. In fact, too large a flow of oxygen directed into the cutting region actually slows progress. Such is not the case for arc cutting where approximately 70 percent of the heating of the metal arises from anode impingement of the electrons. The remaining 30 percent is convective heat transfer from the hot plasma. Tracing through the various energy transformations shows the high efficiency of this anode heating.

Assuming an electrical-to-thermal energy conversion of 80 percent for torch operation at 130 v and 100 kw delivered to the torch, only 20 kw is distributed between the cathode and the anode drops. With a 5 percent loss to the cathode, only 15 percent of the total available electrical energy reaches the anode. Yet, this 15 percent accounts

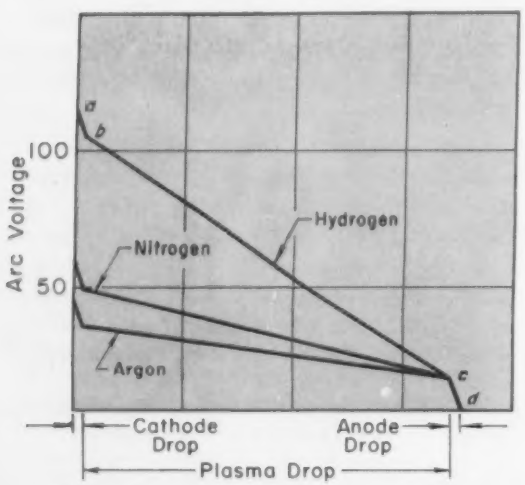

Fig. 4. Effect of arc voltage on gas heating.

for 70 percent of the heat transfer to the work! This result is to be expected, however, as convective heat transfer from a high-velocity hot gas to a surface is very inefficient. I^2R heating at the anode surface is 100 percent efficient.

There appears to be no upper limit (imposed by the process itself) on the speed of plasma-arc cutting. Power is the major criterion. The greater the power, the greater the volume of kerf material removed. Unfortunately, a doubling of the power level does not necessarily double the cutting speed. The arc column increases in diameter leading to wider kerfs with increased power.

All conducting materials are readily cut by the transferred arc. Of particular interest is the cutting of mild steel and a comparison of costs as compared to the oxygen cutting. At 100 kw, ¾-inch steel plate is cut at 70 ipm. Maximum oxygen cutting speed is about 20 ipm.

Including labor costs oxygen cutting for this application costs $4.56 per 100 feet of cut, whereas the comparable cost for plasma-arc cutting is $2.10 per 100 feet. These figures are for one particular case. Greater economy is to be expected for the arc system with higher powers and with thinner materials. Steel plate, ¼-inch thick, is cut by the arc at 100 ipm at 40 kw. Recommended oxygen cutting speed is 26 ipm. The ratio of savings in favor of the arc process is now 3:1. Other labor-plus-overhead rates may prevail, and these will adjust the calculations accordingly. The high initial cost of the arc equipment must be amortized. Thus, only those concerns doing quantity cutting of mild steel will use the arc method.

Metallizing is a second major use of plasma equipment. In this case the plasma flame, or non-transferred arc, is used. *Fig.* 1 shows a spray composed of fused tungsten particles. The tungsten powder is contained in the small hopper shown in the rear. A feed gas delivers the correct flow of powder to the torch unit where it is forced into the plasma stream. Tungsten and many other refractory materials have hitherto not been able to be sprayed. Their melting points are well above the temperature of the oxy-acetylene flame.

Other applications suggest themselves. Perhaps of major importance is the substitution of the plasma flame for the oxy-fuel flame in many ordinary applications. On a basis of cost per unit of heat produced, electric energy is usually much less than for oxygen and fuel. The higher temperature of the arc flame (considering the Carnot efficiency) leads to more efficient utilization of this heat. Comparison tests between a plasma flame device and an acetylene torch of identical total heat output show the former to be nearly twice as effective in its ability to heat a body of material to the fusion point.

The majority of plasma equipment is being used for experimental and development purposes. From these programs will evolve many additional applications. Possible applications which suggest themselves include lathe cutting as well as drilling of hard-to-machine materials. The transferred-arc would probably be used. Difficulties would be associated with the heating and quenching of the underlying metal layer.

It is to be expected that plasma flame will become of increasing importance within the near future. Manufacturing industries may well benefit from these new and versatile techniques.

why form explosively?

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Forming at 300 to 800 feet per second, using energy from high-explosives, is practical from a production point of view. Equally important is the fact that practical economics also may favor the adoption of this process by industry.

Abstracted from Paper 291, "Why Form Explosively?" to be presented at the 28th ASTME Annual Meeting. Copies of the complete paper will be available for purchase from Society Headquarters.

TOOL AND MANUFACTURING ENGINEERS have been been quick to take advantage of the explosive forming process. Explosives are a low-cost source of energy and explosive energy can be directed in three dimensions simultaneously. At the same time, explosive forming has certain limitations. The advantages—and limitations—of this revolutionary metalworking method can best be understood by examining the phenomena involved in an explosion.

Analysis of an Explosion: When an explosion is initiated at one end of a solid cylindrical charge, the solid is chemically transformed into a gas. If the transformation proceeds at the same rate as the physical disturbance resulting from the reaction, the result is called "detonation". The velocity of the transformation through the explosive is defined as the detonation rate and ranges from 4000 to 30,000 fps, depending upon the type of explosive used.

If the chemical reaction cannot keep pace with the pressure and particle motion it creates, the process is known as "burning". It proceeds at a fast rate, but not as fast as detonation. Explosives are classified into two groups: those that detonate—high explosives—and those that burn—propellants.

Gas at a detonation front is at extremely high pressure and temperature in relation to ambient conditions. The pressure begins to be relieved by the formation of a pressure wave which has, in the case of a detonating high explosive, a discontinuous sharp front, or shock wave. Behind this shock wave an

exponential type pressure decay exists. Significant features of this shock wave are that its velocity of propogation is higher than the velocity of sound in the surrounding medium and that its pressure falls off more rapidly with distance than would normally be the case with an acoustic wave.

If water is used as the transmitting medium between the explosive and the workpiece the situation is modified. Assuming an infinite water medium, the gas bubble generated by the transformation of the charge from solid to gas expands very rapidly. Although internal pressure is reduced by expansion, the inertia of the moving water produces a bubble larger than would be sustained under stable conditions. As soon as the pressure falls below the equilibrium level, the gas bubble starts to contract. A significant pressure wave is generated when the bubble is at its minimum volume. The peak pressure of this wave is generally no more than 20 percent of that of the shock wave but its duration is greater.

Actual Conditions: In explosive forming the water medium is not infinite and the surfaces of the container walls and the workpiece reflect the shock wave, resulting in either a pressure drop or rise. When the shock wave passes through air to water, through air to steel or through water to steel, a rise in pressure occurs. When the wave is reflected in the opposite direction a drop in pressure results. These reflected waves alter the pressure profile to a considerable degree and make quantative analysis extremely difficult, particularly since the reflecting surfaces are acoustically dissimilar.

The interaction of the primary and reflected waves is complex; however, the combination of phenomena produces either explosively formed parts or shrapnel.

A pressure-time curve for explosive forming is shown in *Fig.* 1. In general, it can be said that when water is used as a transmitting medium, the forming is accomplished first by the pressure differential across the shock front and secondly by the pressure wave from the bubble expansion.

Velocity and pressure have definite effects on material elongation. It has been established that the elongation of certain metals is considerably increased when they are stretched under high hydrostatic pressures. Also, stretching materials at high velocities affects the elongation so that when a given velocity is reached the material changes from a ductile to a brittle condition. Unfortunately there is little evidence of any improvement in elongation or improvement in formability in the explosive forming operations that have been accomplished to date.

Test Results: This statement is based on results obtained during investigations being conducted by Lockheed for the Air Materiel Command. The ma-

Fig. 1. Simplified pressure-time curve for explosive detonated in an infinite water medium.

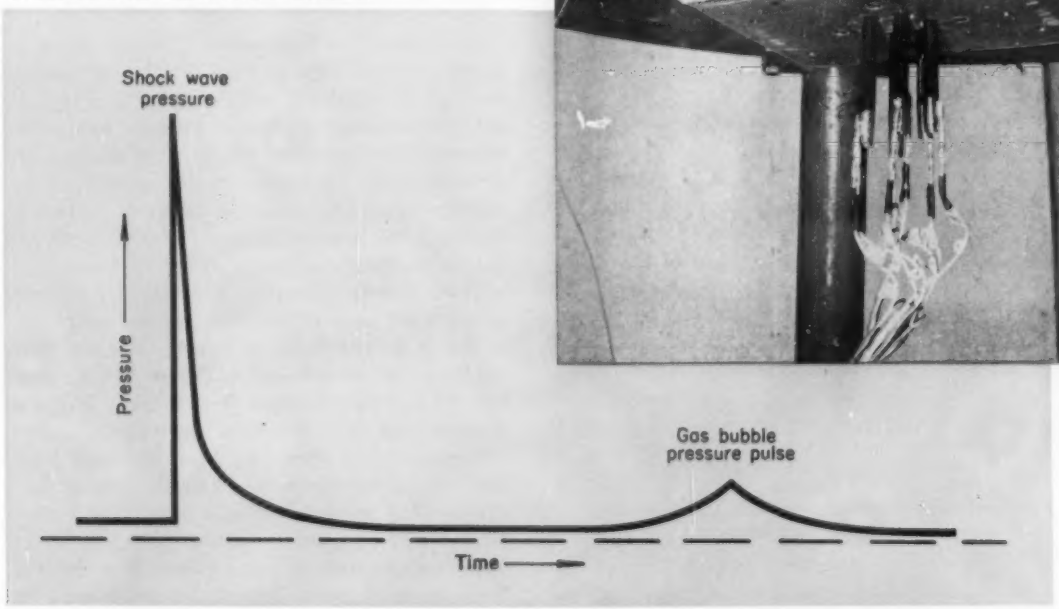
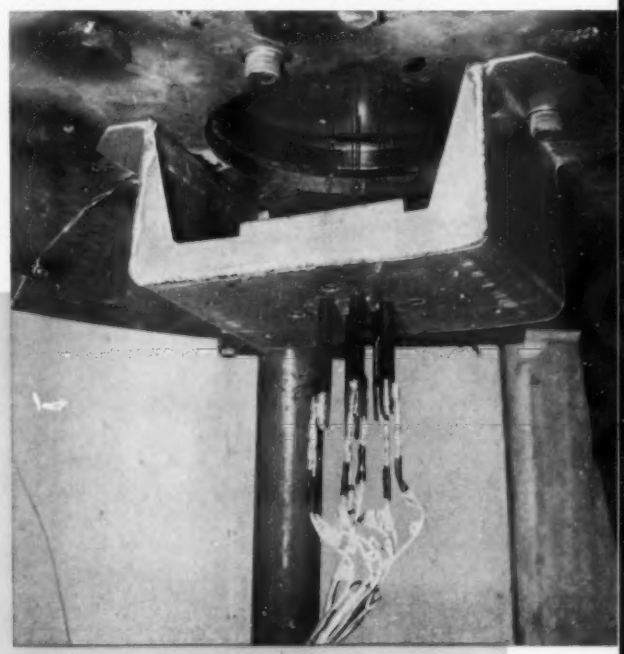


Fig. 2. Setup for obtaining temperature-velocity measurements. Pencil leads contact workpiece.



Strain Rate and Velocity Data—Six-Inch Hemispherical Cups

Type of Material	Thickness of Material	Condition of Material	Charge Weight (grams)	Peak Vertical Velocity (fps)	Strain Rate (in./in./sec.)	Relative Velocity in 0.25 in. (fps)	Relative Velocity in 2.0 in. (fps)	Critical Impact Velocity (fps)
Vascojet-1000	0.025	Heat-treated	1	278	46	3	8	40
AM350	0.025	Heat-treated	6	501	237	7	40	240
6A1-4V Titanium	0.025	Heat-treated						
Vascojet-1000	0.025	Annealed	10	450	329	5	42	
AM350	0.025	Annealed	6	476	273	6	47	
6A1-4V Titanium	0.025	Annealed						
8Mn Titanium	0.025	Annealed	7	411	188	4	32	305
Vascojet-1000	0.063	Heat-treated	4	343	108	6	19	
AM350	0.063	Heat-treated	16	755	407	9	69	
6A1-4V Titanium	0.063	Heat-treated	17	796	280	8	48	

terials being investigated are Vascojet-1000, a 5 percent chrome air-quenching steel; AM350, a semi-austenitic precipitation-hardening steel; 6A1-4V titanium; and 8Mn titanium. Tests have been performed with various weights of high explosive suspended in air and water, at different distances from the workpieces, which were in either the annealed or heat-treated condition.

During this investigation, velocity and elongation changes have been successfully measured. The set-up for obtaining velocity measurements is shown in *Fig.* 2. The illustration shows the underface of the workpiece which, when in motion, contacts prepositioned pencil leads. The leads provide a trace on an oscilloscope. The die diameter is six inches. The information obtained is plotted as distance versus time, *Fig.* 3. It can be seen that there is an initial velocity (which appears to be the peak velocity) that diminishes on a gradual curve. *Fig.* 4 shows a similar curve for another material. In this instance the initial velocity received an additional impulse, providing an acceleration to peak velocity with a subsequent fall-off. It is not clear what provided this acceleration. Possibly it can be attributed to the gas-bubble pressure impulse.

When air is used as the transmitting medium, the final shape of the workpiece is more irregular than when using water. In air there is no secondary pressure pulse. Thus to achieve good forming, a water medium should be used. In water the shock wave pressure differential sets the workpiece in motion in a flat plane and the secondary pressure pulse acts on the newly formed conical shape, tending to form it into a more spherical shape.

The instrumentation required to measure the pressure-time profile is complex. However, the velocity curves provide some interesting information. First of all it can be seen in *Fig.* 4 that the blank formed to a permanent set depth of about 0.35 inch, while a depth of 0.6 inch was reached during the forming cycle. This springback is very substantial and contradicts previous claims of no springback associated with the process.

In addition *Fig* 4 gives information from which the velocity of forming can be derived. From the formability viewpoint, the velocity of forming is the velocity at which two particles move apart in relation to each other. Care must be taken to obtain the proper velocity of forming, as can be seen in *Fig.* 5 In *Fig.* 5a, it is assumed that the workpiece sheared at the draw radius and was propelled through space at velocity V_p. No relative particle velocity exists and although the material is being displaced no forming occurs. In *Fig.* 5b the par-

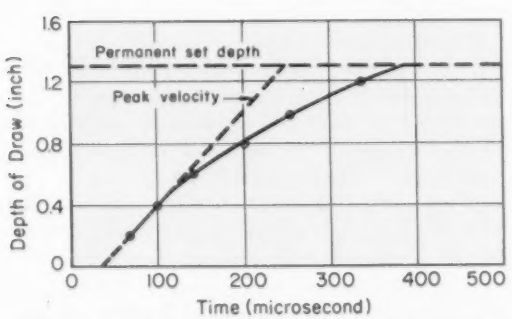


Fig. 3. Depth of draw versus time for forming a six-inch diameter hemispherical cup. The material is 0.025-inch thick AM 350, 180-200,000 psi. The explosive was six grams of Composition C-3.

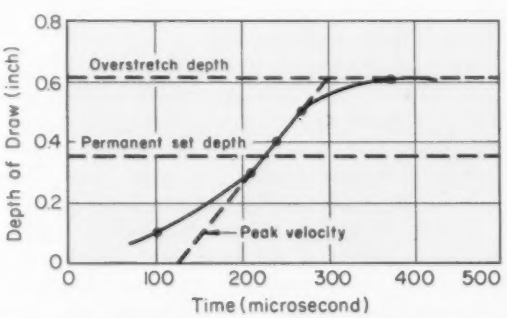


Fig. 4. Depth of draw versus time for forming a six-inch diameter hemispherical cup. The material is 0.025-inch thick Vascojet 1000, 260-280,000 psi. The explosive was one gram of Composition C-3.

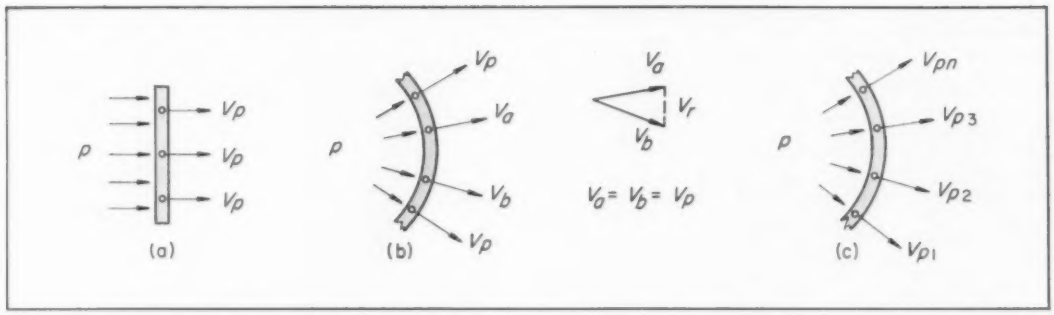


Fig. 5. Theoretical model of metal forming. Forming cannot take place when all particles are moving in the same direction at the same velocity, as shown in (a). In (b) the particles are moving in different directions at the same velocity. Forming is possible. In (c), which is probably typical of explosive forming, particles are moving in different directions at different velocities.

ticles are moving at the same velocity V_p but in different directions. The velocity vector V_r becomes the measure of relative particle velocity between two particles a given distance apart. The situation shown in *Fig.* 5c is probably the condition that exists during explosive forming. The particles are moving in different directions at different velocities. It can be seen that the velocity measured in the setup previously shown in *Fig.* 2 records V_a. When considering elongation changes with velocity, V_r, which is considerably less than V_a for explosive forming, is of greatest importance.

Recorded velocities for certain metals are shown in the accompanying table. The column headed "Peak Vertical Velocity" shows the peak velocity through space of the workpiece for the materials listed. The column headed "Relative Velocity in 0.25 in." shows the relative velocity between two particles 0.25 inch apart. This velocity is the V_r velocity previously referred to. The next column shows the same velocity when the particles are two inches apart. It is evident that these velocities are not high when compared with the critical impact velocities in the extreme right-hand column. Increasing the charge weight above that shown in the table may have increased the velocity during the tests but it always shattered the workpiece. Elongations recorded under these circumstances were about the same as for static conditions.

Although the V_p velocity may be relatively low, it is certainly higher than in conventional forming. The velocity through space of a workpiece formed on a mechanical press at 1000 spm over one and a half inches is approximately 4 fps, considerably less than the 300 to 800 fps for explosive forming.

In order to improve elongation, it appears necessary to modify the pressure-time profile during the explosive forming cycle. The pressure tail behind the shock wave needs to be sustained either by reflection or by sequenced firing of multiple charges. The pressure pulse from the water bubble expansion will still be advantageous, although the whole picture will be so modified by reflections as to make a true analysis difficult. Under these conditions of sustained high pressures and with higher forming velocities higher elongations may be possible.

Tooling: At present the general requirements for an explosive forming facility are a large tank of water, a female die, a vacuum beneath the workpiece and suitable explosives. The die may be of Kirksite, steel or ductile cast iron. Care is needed to insure that an effective seal is provided between the workpiece and die to contain the vacuum and also to prevent water from filling the cavity. The vacuum permits the workpiece to reach the die surface and also prevents burning of the surfaces caused by adiabatic heating of entrapped air.

The type of explosive used depends upon the application. Lockheed has concentrated on high explosives, using Composition C-3, which is a mixture of RDX in a plasticizer, PETN primacord and plastic sheet. These explosives have the advantages of being sufficiently stable to permit safe handling and also have high detonation rates. If lower detonation rates are needed, gelatin dynamites can be used but the hazards associated with them must not be overlooked. A desirable explosive would be one covering the detonation velocities between 10,000 and 20,000 fps and with good safety characteristics.

Explosive forming permits the manufacture, in one piece, of parts that are usually made by forming and assembly several individual components. The economic advantages are obvious. In addition, it provides a satisfactory method for forming large heat-treated parts that would otherwise be formed on large presses. Capital investment savings result. Explosive forming will become more important with further research and development into the fundamentals of the process. If, for example, the pressure profile within the explosive cycle and the velocity of forming of the workpiece can be brought under control and modified to increase the material elongation, the future of the process will have no limit.

COLD SWAGING

. . . extends design horizons

Fig. 1. Swaging machine built for development and testing.

By **P. A. G. Carbonaro** and **S. Valencia**
Rodman Laboratory, Watertown Arsenal
Watertown, Mass.

Swaging process not only lends itself to the production of varied internal contours with extremely close tolerances but also results in the production of extremely fine surfaces. Gun barrel rifling can be swaged with considerable cost savings over other methods.

Abstracted from Paper 290, "Precision Forming Techniques (Cold Swaging)" to be presented at the 28th ASTME Annual Meeting. Copies of the complete paper will be available for purchase from Society Headquarters.

DRASTIC CHANGES in weaponry call for lightness, more intricate designs, considerably higher strengths, greater toughness and, for many applications, resistance to high temperatures. These requirements, coupled with increasing labor costs, make mandatory the development of new techniques as well as improved tooling for production.

In the search for new techniques to meet these exacting requirements and to produce a higher quality product, cold swaging appeared to offer promising advantages. The precision process developed consists of plastic reshaping of tubular workpieces by means of high pulsating pressure applications produced by rotating and simultaneously striking dies. While the outside diameter of the tubular workpiece is being reduced, varied internal contours (such as splines) can be produced

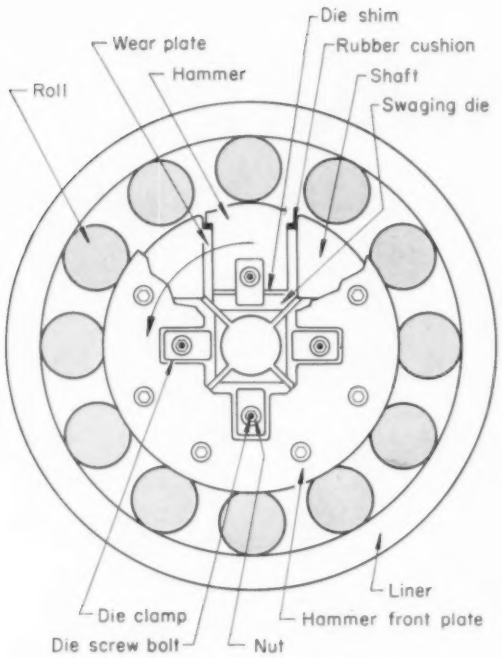


Fig. 2. Principle of operation of swaging head, showing hammers in open and in closed positions.

by introducing into the inside of the workpiece a contour mandrel. The shape of this mandrel is reproduced on the inside of the tubular workpiece.

Machine Tool: The swaging machine, shown in *Fig.* 1, was designed and developed for the General Thomas J. Rodman Laboratory of the Watertown Arsenal. It is capable of producing intricate internal contours within cylindrical components and consists of two main units, the actual hammering unit known as the head and the feeding unit known as the slide.

The swaging mechanism in the head consists of all the components necessary to make the hammering operation complete. The schematic drawings shown in *Fig.* 2, show the main components of the head with the hammers in the closed and open positions, respectively. The shaft, in which the four hammers are located crosswise, is actuated by means of a 40-horsepower motor over a flywheel which is connected to the motor by V-belts. Twelve rollers, equally spaced through the roller cage, are equipped at both ends of the rollers with a spacer ring. Spring power and centrifugal force effect a steady contact between the sinusoidal back surface of the hammers and one (or two) rollers and between the surface of the rollers and the liner.

When the machine is in operation, the shaft rotates rapidly, at approximately 250 rpm. As a result of this rotation of the shaft, the hammers with their curved backs pass over the rollers, thus exerting a powerful squeezing action onto the workpiece through interchangeable swaging dies.

Composition of Die Steels

Type	C	Mn	Si	Cr	W	Va	Mo
A*	0.85-1.10	0.90-1.40	0.25-0.50	0.40-0.60	0.60 max	—	—
B	0.35	0.30	0.30	3.50	9.00	0.40	—
C	1.00	0.70	0.30	5.25	—	0.25	1.15

*B4-(Army-Spec.)

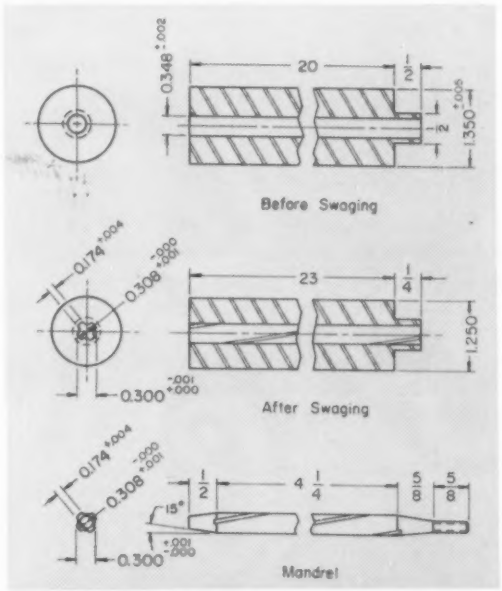


Fig. 3. Rifling test showing workpiece dimensions before and after swaging and details of mandrel.

All the hammers work simultaneously and the stroke is given by the high point of the sine curve on the back of each hammer. The hammers apply approximately 2000 blows per minute.

Containing the workpiece feeding mechanism, the slide utilizes a doublescrew drive with adjustable nuts. These screws actuate the slide carriage, in which the freely rotating push rod for supporting the workpiece is installed. The screws are driven by a variable-speed motor and chain drive over a cross-connected train of gears having two speed ratios and a special forward and reverse quick-feed gear. Feeding speed can be set to vary from 5 to 100 ipm. The slide is capable of feeding a workpiece with a maximum length of 60 inches and a maximum feed pressure of 40 tons.

Besides the head and slide the machine is equipped with a mandrel drive and a back-pressure attachment. The former is used to carry out all the movements necessary for the mandrel during the swaging operation and the latter is required for guiding and keeping the workpiece centered during swaging and for ejecting the work upon completion.

Typical of the applications under investigation are the rifling of small arms, the forming of both chamber and rifling of small arms in one operation, the swaging of uranium blanks, the swaging of two dissimilar materials into one part.

Chambering and Rifling: Typical of rifling investigations which have been conducted is the rifling of .30 caliber rifle barrels. The material used for the blanks was SAE 4150 steel heat treated to a Rockwell C Hardness of 32. The starting tubular workpieces used for these investigations were 1.350 inches in outside diameter, 0.348 inch in inside diameter and 20 inches in length. *Fig.* 3 shows the dimensions of the workpiece prior to swaging, the rifled barrel after swaging, and the mandrel used for rifling. Based on these dimensions the percentage reduction and elongation being obtained were 14 percent. These tests have proved that the new technique can hold close tolerances and produce good surface finishes. As shown, the inside diameters have been held to within 0.0005 inch on the .30 caliber rifle barrels. In addition, the surface finish was improved from 75 microinches to an average of 8 microinches. Finally, since the swaging speeds for these tests have been in the range of 10 to 15 ipm, the rate of productivity can be considered relatively high for this type of operation.

In addition to the rifling tests, successful experiments have been conducted which include the swaging of both the chamber and the rifling of .30 caliber rifle barrels in one operation. The starting tubular workpieces used for these experiments were 1.350 inches in outside diameter, 0.348 inch in inside diameter, 23 inches in length and with a counterbore of 0.472 inch in inside diameter and 1.770 inches in depth. *Fig.* 4 shows the workpiece prior to swaging, the dimensions of the chamber and rifling after the swaging operation, and the mandrel tool. The chambering and rifling mandrel is a two-component tool jointed in the manner shown by the drawing of the tool.

During the swaging of the chamber portion, both chamber and rifling mandrels travel forward to-

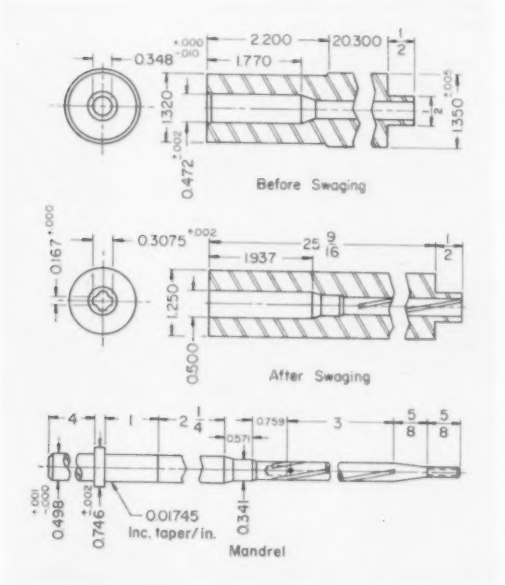


Fig. 4. Chambering and rifling operation showing details of part and two-piece mandrel.

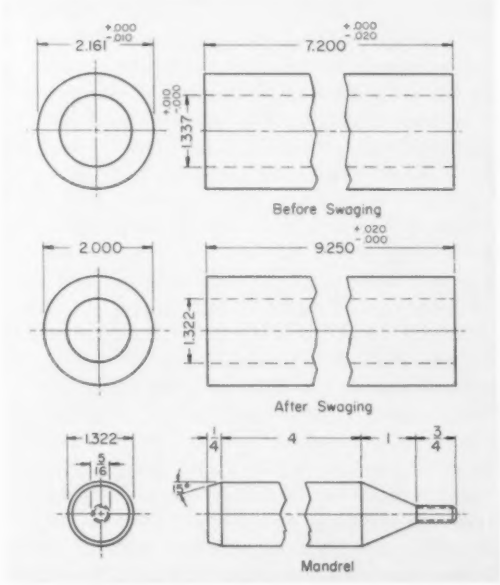


Fig. 5. Swaging of cast uranium metal billets, showing dimensions before and after swaging.

Fig. 6. Inserting heated uranium billet in machine. Precautions were observed for radiation protections.

gether with the workpieces. Immediately upon the completion of the chamber portion, the chamber mandrel separates from the rifling mandrel and continues traveling forward with the workpiece while the rifling mandrel is automatically locked in place within the throat of the dies and from then on cannot travel forward.

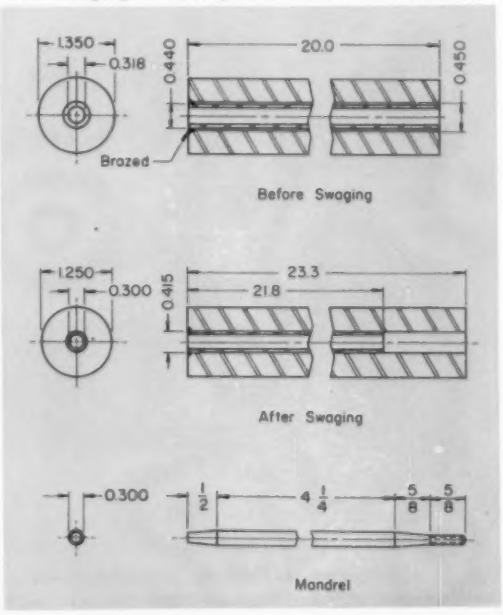
Swaging of Uranium: A short-range development program was conducted to determine the feasibility of employing the swaging process in the final shaping of uranium metal blanks for an Atomic Energy Commission application. The objective was to produce a required number of uranium metal cylinders 2.000 inches in outside diameter, 1.322 inches in inside diameter and 9.250 inches in length with enough reduction to produce grain refinement. Although the radioactivity of the material employed was extremely low, special precautions were taken during the processing of the metal to control radiation contamination. The material used for the starting blanks consisted of cast (normal) uranium metal billets which were machined to 2.161 inches +0.000 —0.010 in outside diameter and 1.337 inches +0.010 —0.000 in side diameter and 7.200 inches +0.000 —0.020 in length. *Fig.* 5 shows the uranium metal blank dimensions before and after swaging and the mandrel tool employed. It was decided to heat the workpieces to approximately 1150 F in a salt bath furnace prior to swaging in order to prevent cold working of the metal. In *Fig.* 6 the heated blank is being positioned in the machine tool preparatory to swaging. A temporary room was constructed enclosing the swaging machine to limit the radiation contamination to one area. The room was provided with a fume separator with ducts to exhaust the contaminated air. In addition, operating personnel employed protective clothing items such as coveralls, rubber overshoes, gloves and respirators.

Based on the dimensions shown in *Fig.* 5 the percentage reduction obtained was 20 percent. The results of the program indicated that the as-swaged dimensions obtained were as required and that the as-swaged surfaces were excellent. Concentricity between outside diameter and inside diameter was held within 0.002 inches.

Swaging of Dissimilar Materials: Another interesting investigation has been the swaging of steel jackets lined with refractory metals. The materials used for these experiments were SAE 4150 steel for the jackets and a variety of refractory metals for the liners. The starting tubular workpieces employed were 1.350 inches in outside diameter and 0.450 inch in inside diameter for the steel jackets and 0.440 inch in outside diameter, and 0.318 inch in inside diameter for the liners. The length of the jackets liners was 20 inches. *Fig.* 7 shows the dimensions of the workpieces prior to swaging, the two dissimilar metals after swaging, and the mandrel employed. Microexamination of transverse sections, cut from the swaged components, revealed a perfect mechanical bond.

Protective Jackets for Uranium: Of less importance but of interest because it serves to indicate the versatility of the process is the recent production of a considerable number of protective jackets for uranium components. The production department at Watertown Arsenal was recently faced with the problem of procuring copper jackets required for the heat treatment of certain uranium components. Because of time limitation, it was

Fig. 7. Drawings showing dimensions for before and after swaging a steel jacket lined with refractory.



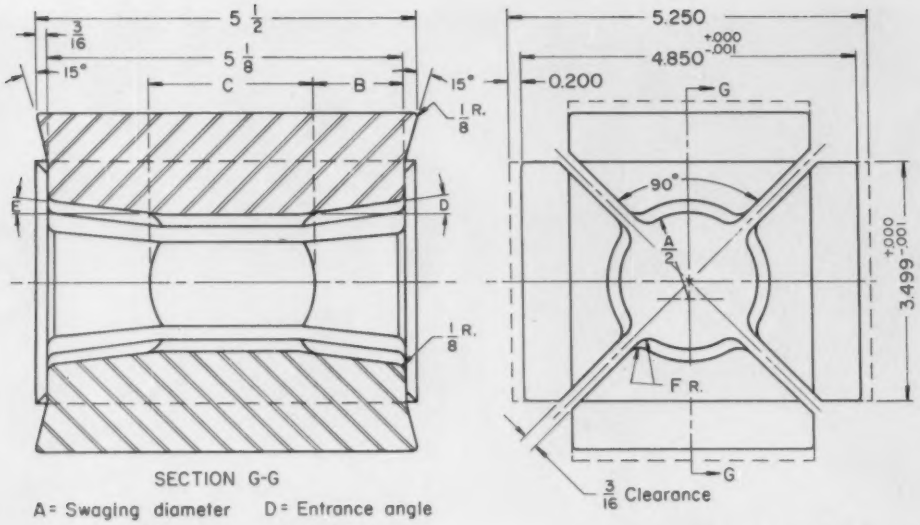


Fig. 8. Design of swaging dies showing critical features.

not possible to purchase the tubular jackets of the required dimensions.

The swaging tool under investigation came to the rescue. Since copper tubing with an outside diameter of 1⅛ inches and a wall thickness of 1/16 inch was available at the arsenal, it was decided to swage it to the required dimensions. Needless to say, the required protective jackets could have been fabricated by other methods but the utilization of the swaging machine served to prove another of the numerous potentialities of the process.

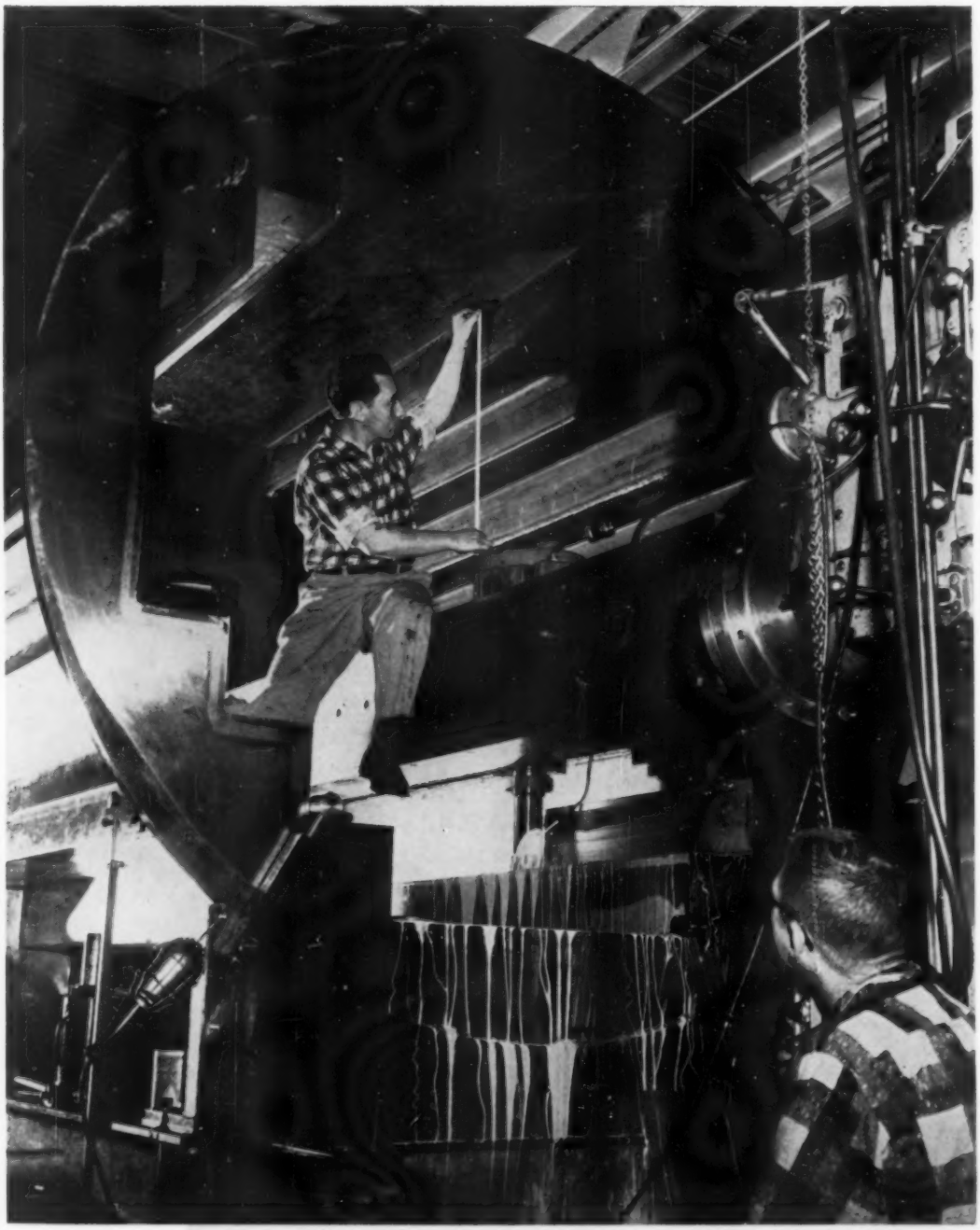
Shock Tube: Currently proposed for investigation is tubing with a 1½-inch-square bore to fabricate a 15-foot-long shock tube. Plans are being made to swage five 3 foot sections which subsequently will be joined to each other by means of flanges. The material to be used for the shock tubes will be stainless steel. The starting tubular workpieces will be 3.250 inches in outside diameter, 2.125 inches in inside diameter and 28.332 inches in length.

Die Design: As must be expected, die shape for swaging is extremely critical and the design illustrated in *Fig.* 8 has been followed as closely as possible. The factors affecting die design are:

1. Entrance Angle: The angle which the inlet end of the dies makes with the horizontal axis. This has been varied from 3 degrees 30 minutes to 5 degrees depending on the application.
2. Die Radius: The radius of the dies at the throat must be 6 to 8 percent more than the radius of the finished component.
3. Exit Angle: The angle which the exit end of the dies makes with the horizontal axis. This has been varied from 1 deg 30 min to 2 deg 30 min.
4. Die Material: The accompanying tabulation represents the types of steels and percentage composition which have been employed for the dies:
5. Die Hardness: All dies which have been employed have been heat treated to 63 Rockwell C.
6. Die Lubrication: The lubrication and cooling of the dies is effected by a flange-mounted pump. This same oil system lubricates the hammers and the rollers. The oil which is being used is eight parts (Military Symbol 2075) to one part cutting oil.

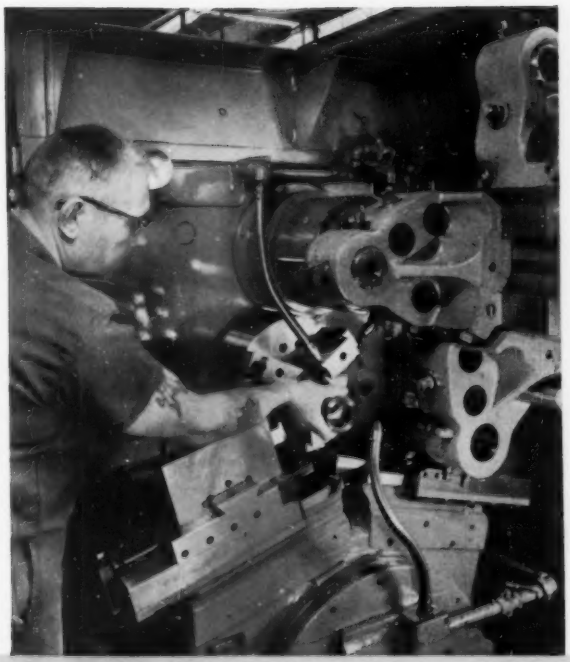
Mandrel Design: The mandrel plays an important part in the operation. It determines the internal contour and the surface finish on the inside of the tubular workpiece. The materials which have been used for the mandrels are tool steels which have been heat treated 60 Rockwell C.

Advantages of Swaging: Advantages which can be derived by the employment of this process are not limited to the close tolerances possible or the fine surface finish which can be obtained. The process holds waste of material to a minimum because metal is displaced instead of cut, and it reduces time on secondary operations to a minimum since only end-trimming of parts is involved. Another particular advantage is the fact that the physical properties of materials are improved by cold working. Furthermore, since such a machine can be automated easily, the process makes economically feasible the mass production of parts. In addition, the process provides the designers more latitude since swaging can make inner contours unobtainable by other methods.

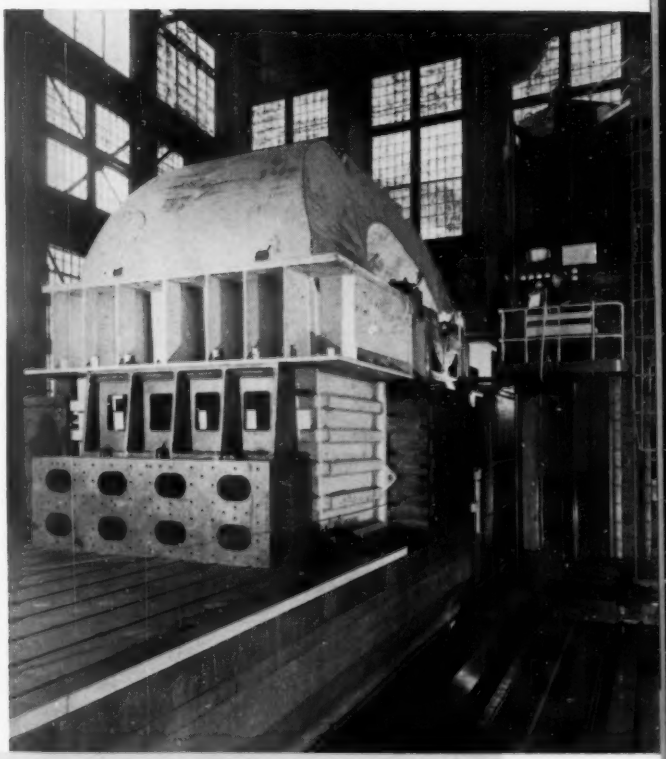


INTERIOR SURFACES of a 304 stainless core baffle for an atomic power reactor are milled with the aid of a special fixture at Westinghouse Electric Corp. The milling head traverses the length of the box section fixture by means of a rack and pinion arrangement. Power for the milling feed is an electric motor mounted on the tool head. The outboard end of the fixture is supported from the shop floor. Accuracy of milling is held within plus or minus 0.001 inch with high-speed steel tools. Fixture was designed and built by R. H. Freitag Div. of Alloy Manufacturing Corp.

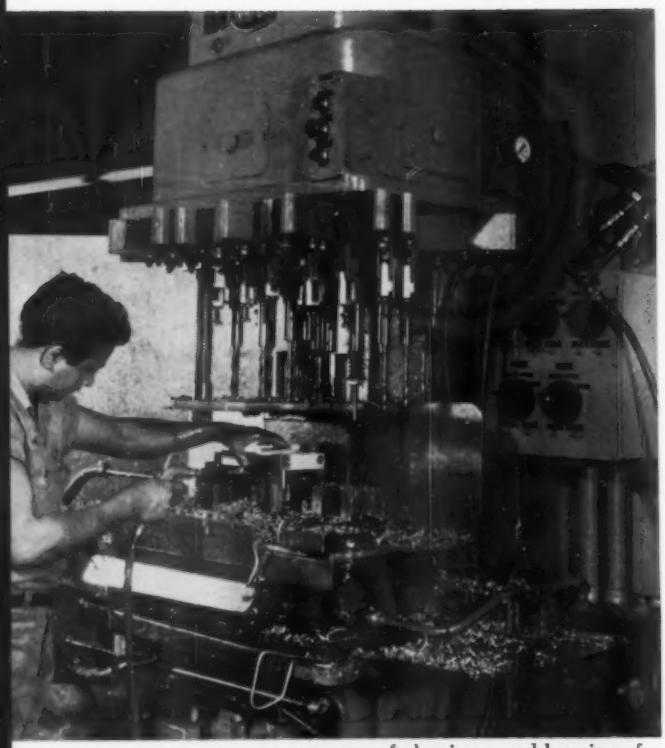
TOOLS at work



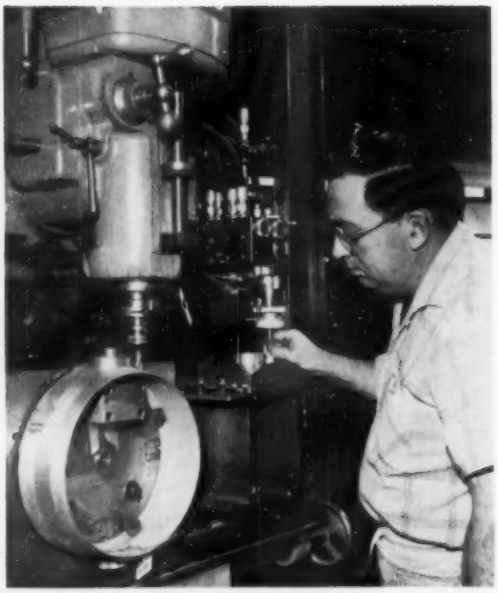
AUTOMATIC SMALL-LOT PRODUCTION of tool steel casings and die shells is accomplished with savings over hand lathe methods in the tool room of Lamson & Sessions Co. Ranging in size from 1⅜ to 8 inches in diameter, the workpiece blanks are cut to length from H-12 tubing by a bandsaw "slugging" method. Then, employing carbide and high-speed steel cutters, the blanks are turned and bored on a Warner & Swasey 2AC single spindle chucking automatic. To facilitate rapid setup and changeover, all tooling is kept simple and is mostly of the single point type.



TURBINE CASING is machined with a seven-inch boring bar on a special boring, milling, and drilling machine. Equipped with an eight-inch spindle, closed circuit TV to read column base scales and an automatic chip-removal system, the machine has a 44-ft longitudinal and 6-ft crosswise column travel and a 20-ft vertical spindle travel. Special features and attachments include a boring and facing head which permits facing a 120-inch diameter circle. Machine is at Allis-Chalmers Mfg. Co.



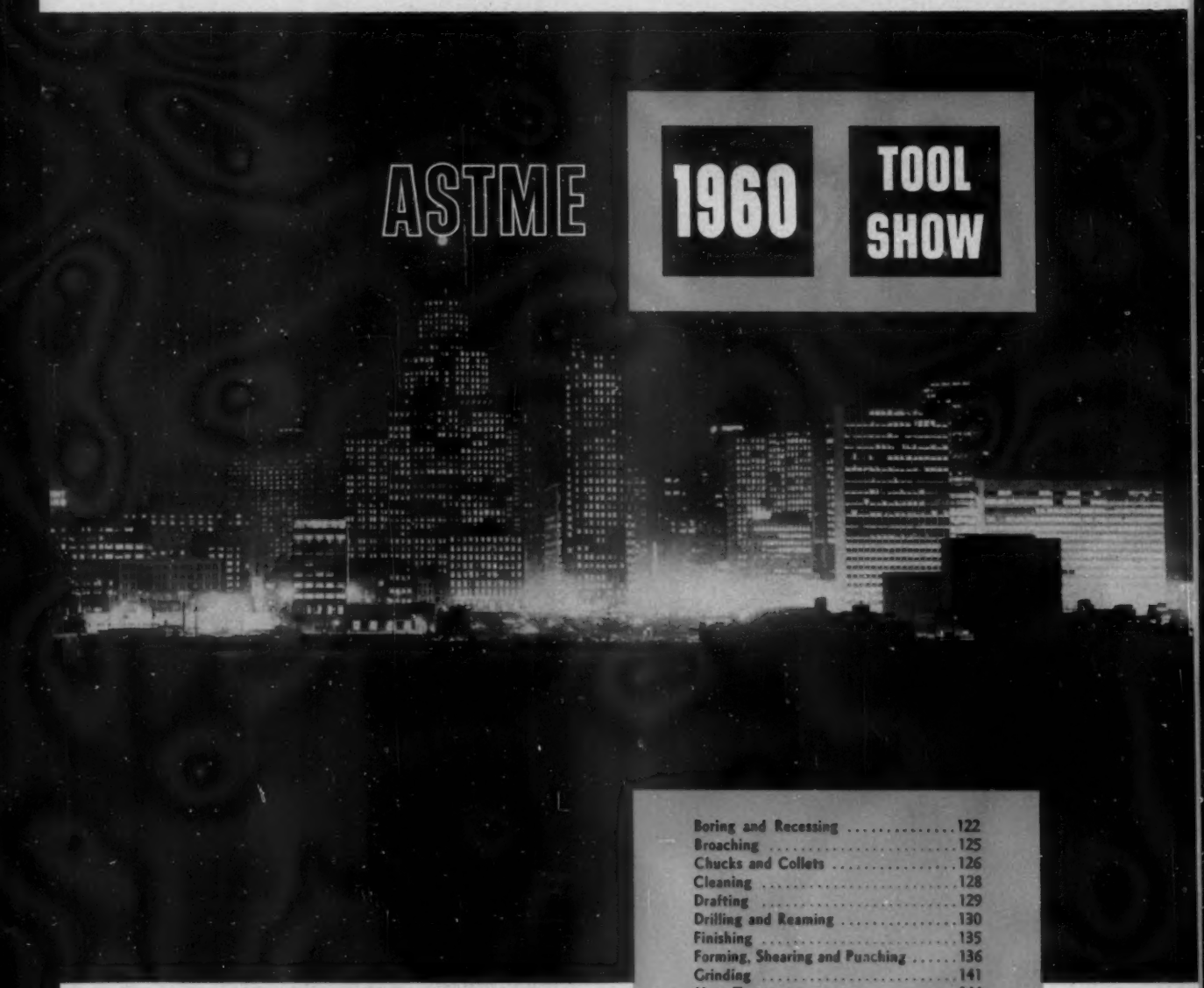
FIVE DIFFERENT SIZES of aluminum end housings for hydraulic cylinders, manufactured at Alkon Products Corp., are drilled and tapped on the same Natco H6 drilling machine. One fixture, mounted on a five-position sliding table, handles all operations. By means of a selector control panel, table positions can be made to drill, step drill, tap or skip.



PURE MOLYBDENUM JETAVATOR HOUSINGS are contoured on a Gorton 3D mill equipped with a True-Trace attachment. The job, performed at Custom Tool & Mfg. Co., is completed in two passes using a high-speed steel two-flute end mill cutter. Tolerances of plus or minus 0.001 inch must be maintained, with surface finish below 63-microinches, rms.

TOOLS at work

PRESS at Pacific Car and Foundry Co., fabricates Byers 4-D wrought iron plate into a bridge trough section. Workmen are forming a one-ft side through a 90-deg bend with a 2¾-inch radius.



Helping to set the stage for what promises to be the most productive decade in our history, the ASTME Tool Show in Detroit, April 21-28 will offer an opportunity for engineers and executives to see the machines and tools they'll need in the years ahead. Pictured on the following pages are tools representative of those on exhibit—tools that will lead to obtaining a share of tomorrow's markets.

Boring and Recessing 122
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Cleaning 128
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Forming, Shearing and Punching 136
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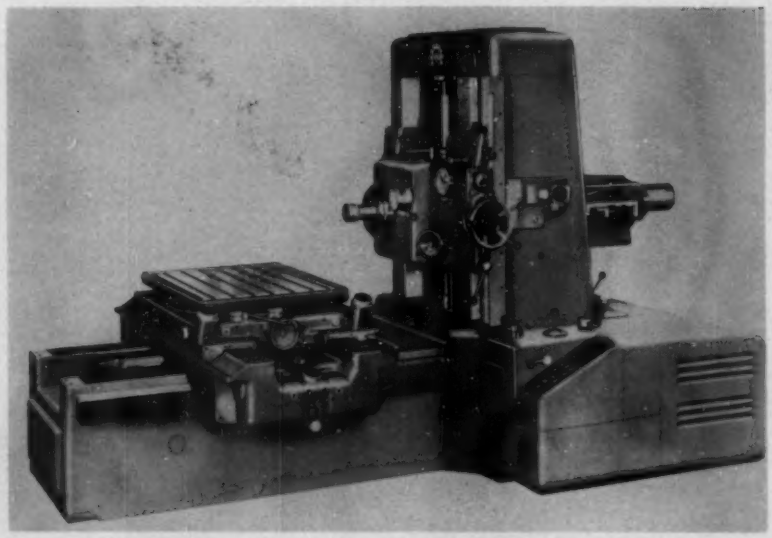
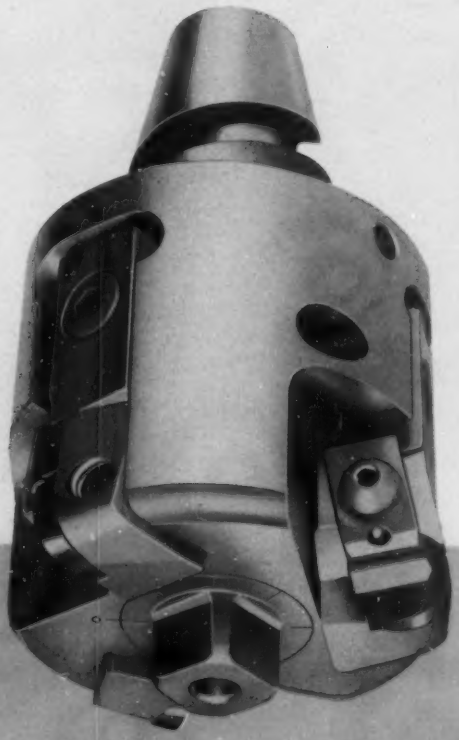
boring and recessing



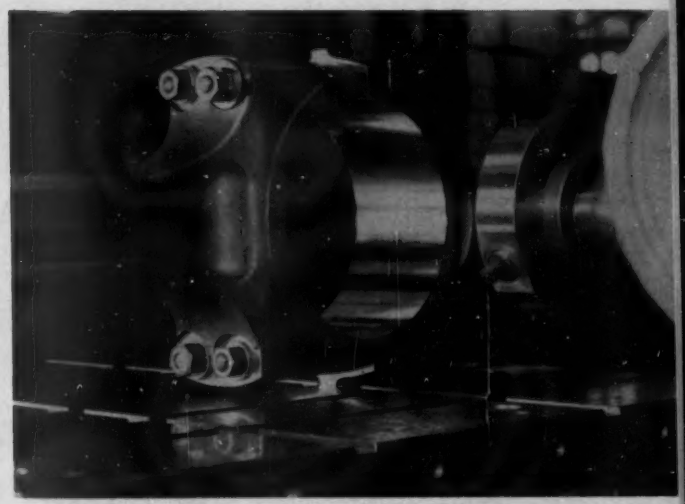
Dixi 75 horizontal optical jig borer features larger table and travels; separate reservoir and recirculating lubrication for the headstock; electrically interlocked hydraulic motions; increased spindle speeds; simplified functional controls; and optional rear support. M.B.I. Export & Import Ltd.

Special tungsten carbide boring bar with shank reduces vibration and deflection on long bars to provide closer tolerances with steel reamers. Kennametal Inc.

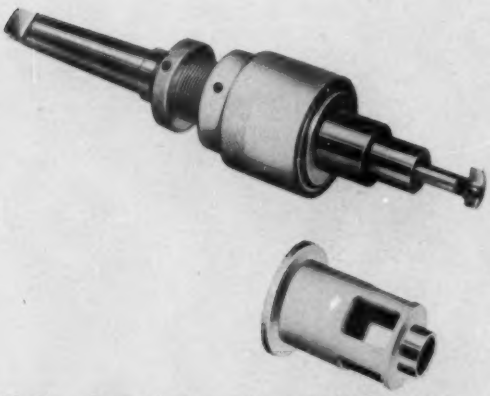


Cartridges on KamSet boring cutter adjust individually for initial setting. To compensate for insert wear, cartridges adjust simultaneously with a single micrometer adjusting cam. Valenite Metals.

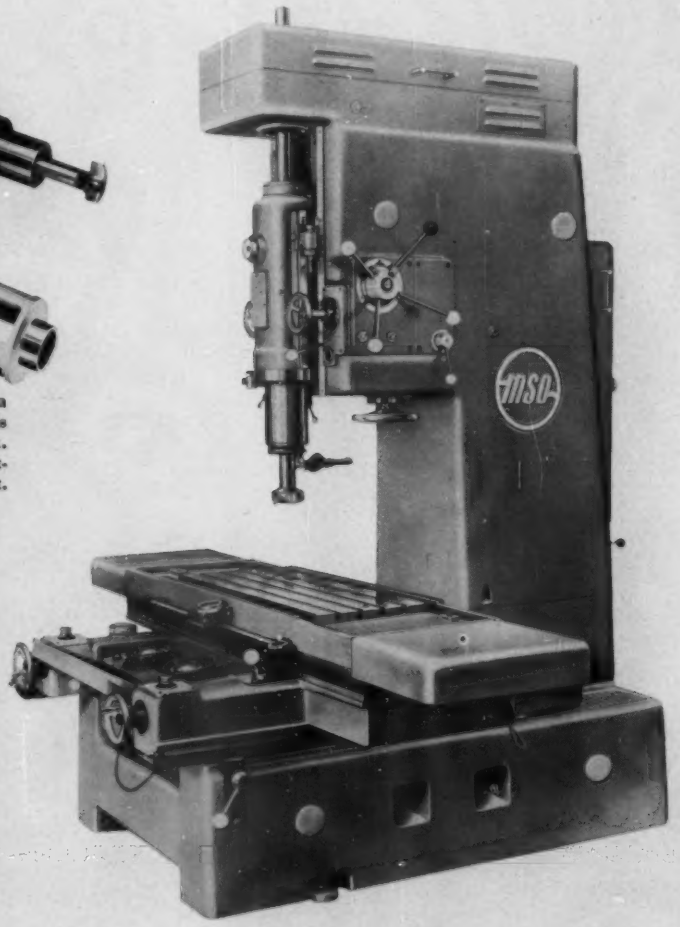
Scully-Jones "Sure-Bore" cartridges are micrometer adjustable with either 53 or 90 deg mounting. Cartridge is adjusted with plastic knob and a wrench. Adjusting mechanism is protected from chips.



Double cone bearing and axial locking force result in a minimum of overhang between cutting tip and cone seat assembly on DeVlieg Microbore tool, thus providing rigidity for new cutting materials.



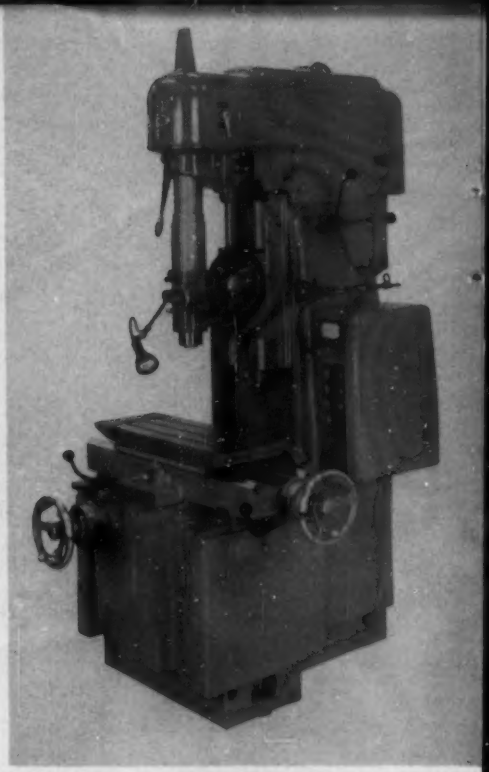
Madison Industries recessing tool has a spiral feed cam which in operation feeds the recessing cover laterally into the work. Snap-on adapator converts tool for piloting in fixture or piloting in piece part.



MSO optical coordinate jig borer offers a provision for speedy setting of movable scales to zero point at any position of table and direct reading to millionths in any direction of the coordinate. Austin Industrial Corp.

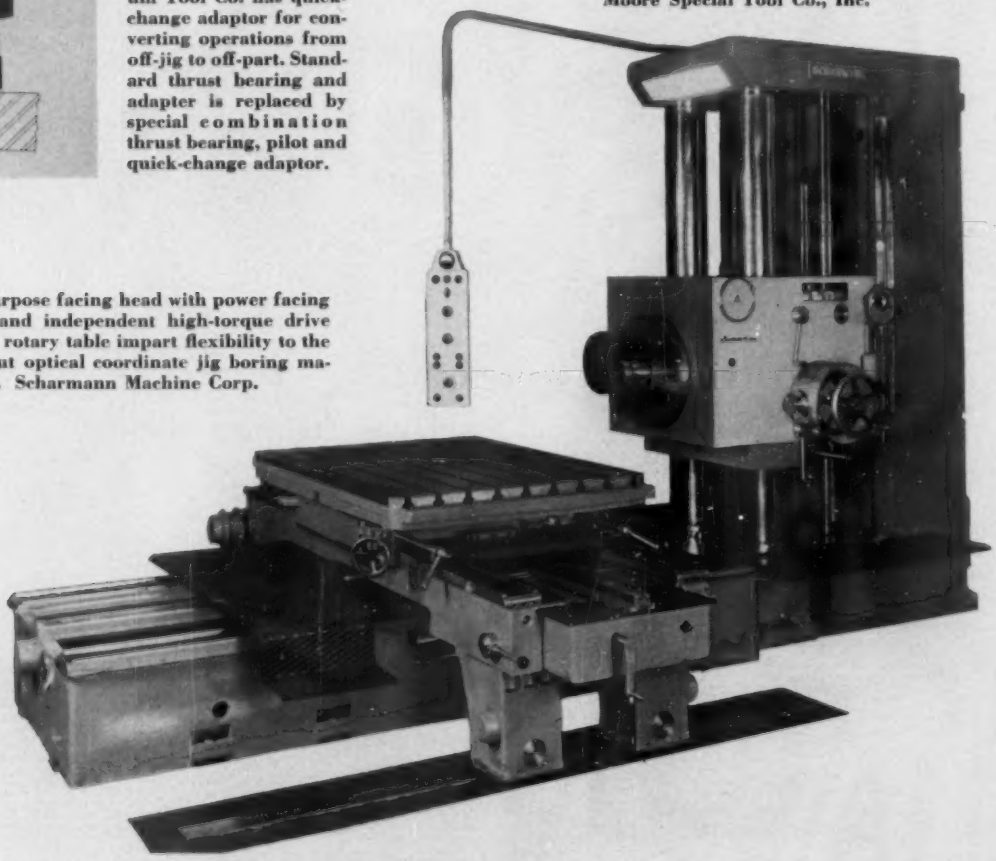
Recessed toolholder manufactured by Bokum Tool Co. has quick-change adaptor for converting operations from off-jig to off-part. Standard thrust bearing and adapter is replaced by special combination thrust bearing, pilot and quick-change adaptor.

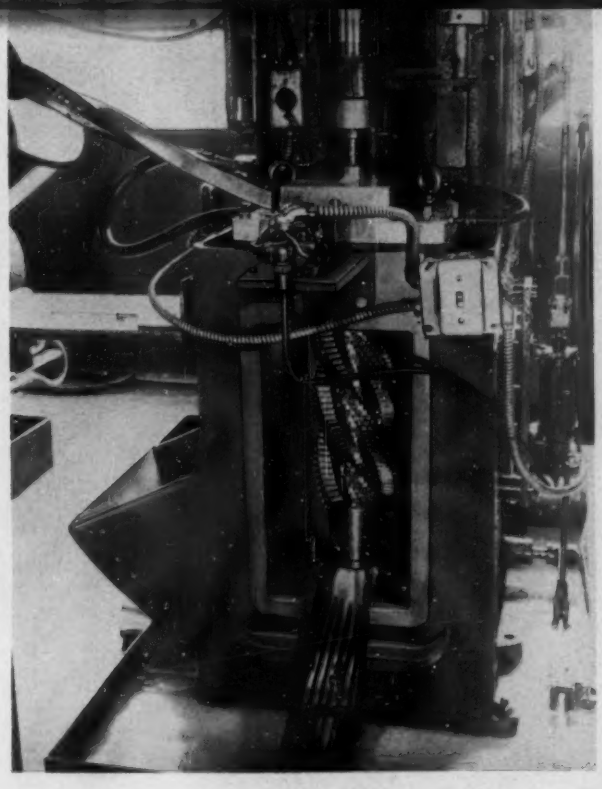
Series 60 offset boring head has horizontal broached hole for holding both round and square tools. Vernier on body facilitates adjustment of the micrometer offset screw. Flynn Mfg. Co.



Newly designed Model 3 jig borer locates and bores holes to less than 0.0001 inch. Machine has all hardened, ground and lapped ways. Table size is 11 x 24 inches. Moore Special Tool Co., Inc.

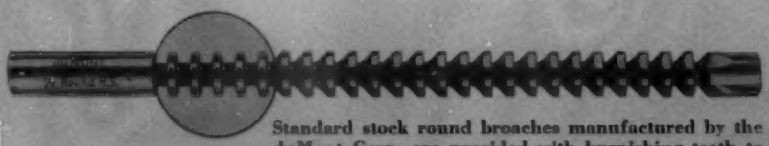
All-purpose facing head with power facing slide and independent high-torque drive and a rotary table impart flexibility to the Opticut optical coordinate jig boring machine. Scharmann Machine Corp.



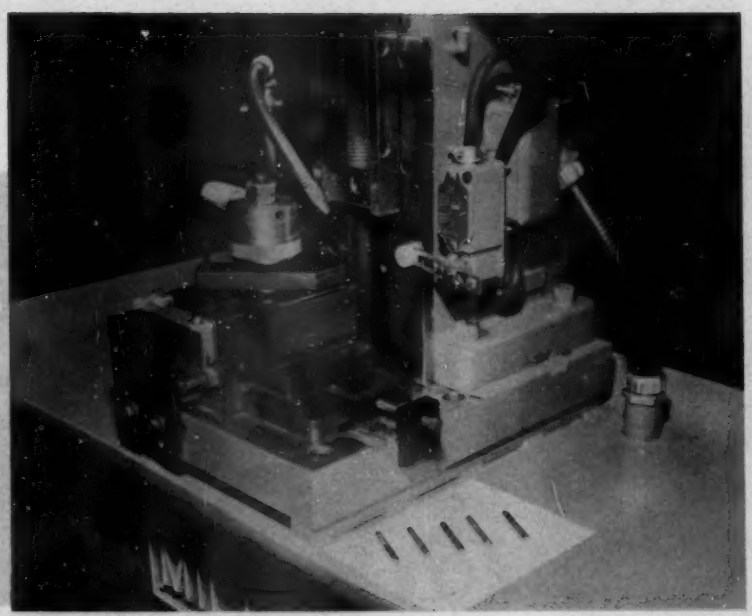


Finishing broaches made by National Broach and Machine Co. consist of a roughing broach and a removable shell type finishing section.

Helical pinion gears are produced on this machine by General Broach and Engineering Co. Helical gears can be produced up to a 15 deg helix angle. The angle can be greater where the part size and design permit the blank to be driven as it passes through.

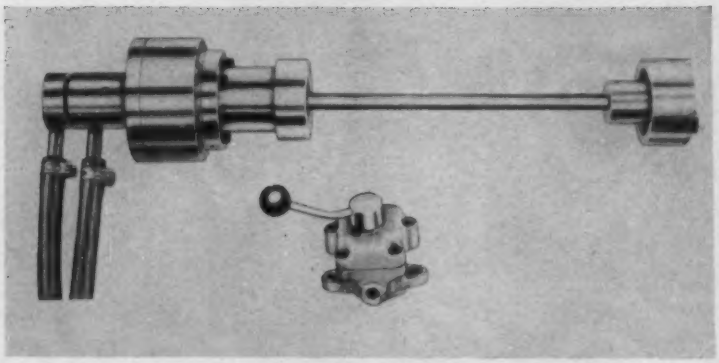


Standard stock round broaches manufactured by the duMont Corp. are provided with burnishing teeth to provide high finish to close tolerances.

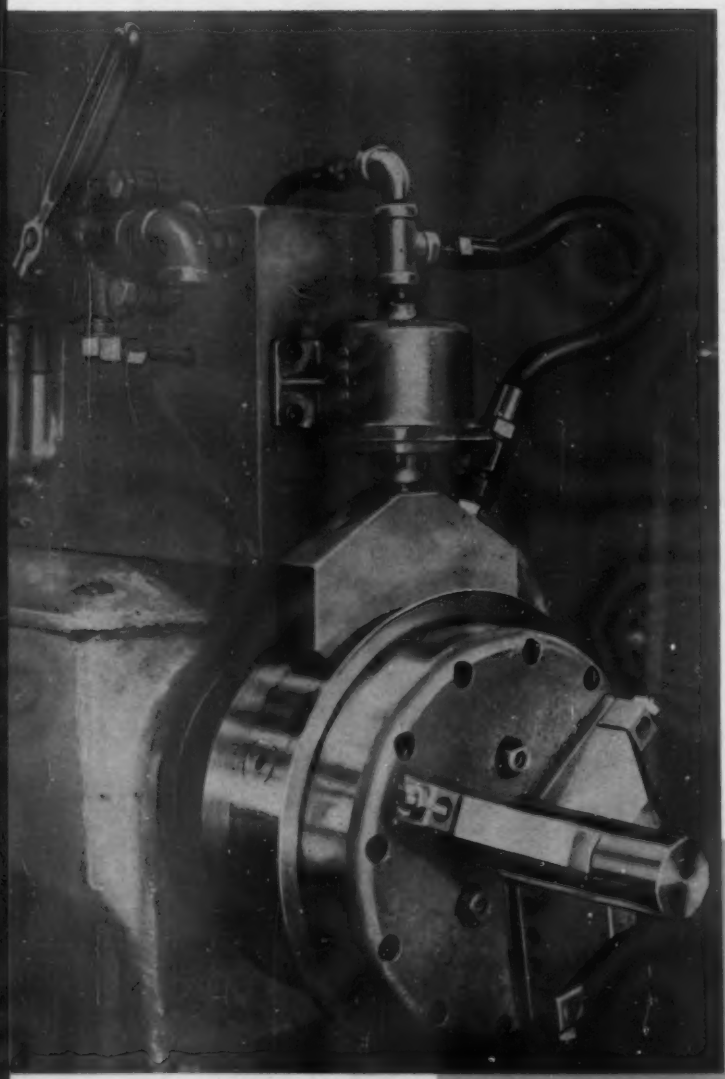


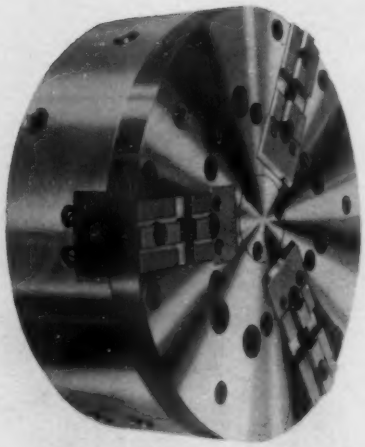
High-speed hydraulic broaching machine for small parts can be used for internal or external broaching. Cutting speed is up to 54 rpm. Tooling is interlocked with machine cycle. Ty Miles, Inc.

chucks and collets



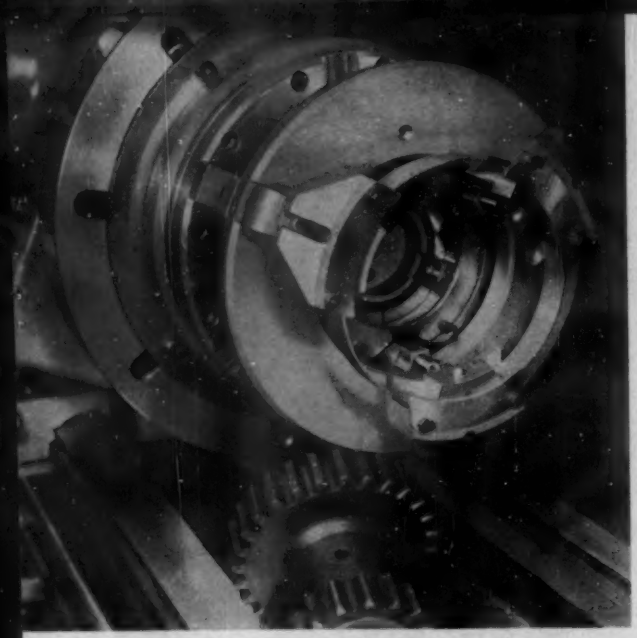
Power chucking unit can be used to convert automatic screw machines to air chucking. The unit, built by Skinner Chuck Co., consists of a four-inch air chuck, either two or three jaws, soft-blank workholding top jaws, a threaded draw bar, a rotating air cylinder, flexible air hose and fittings, a cylinder adaptor and three-way control valve.



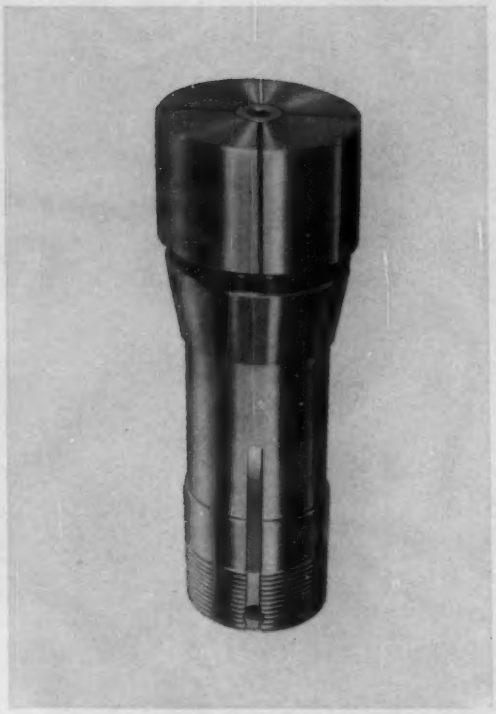


Power chuck with aluminum body has two tapered gibs under each jaw working in tapered keyways. Tightening gibs preserve original accuracy of chuck. Aluminum body reduces weight while steel front and back plates eliminate distortion. Buck Tool Co.

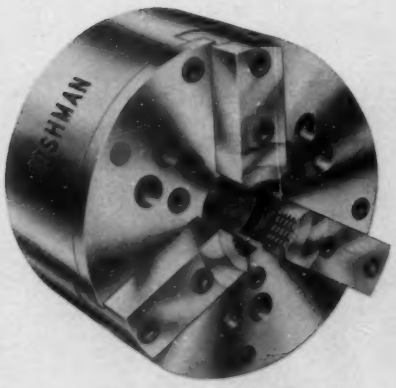
An air actuated shoe contacts the periphery of chuck adaptor plate when the air valve is turned on. After the part is in chucking position the air is turned off and the shoe retracts. N. A. Woodworth Co.



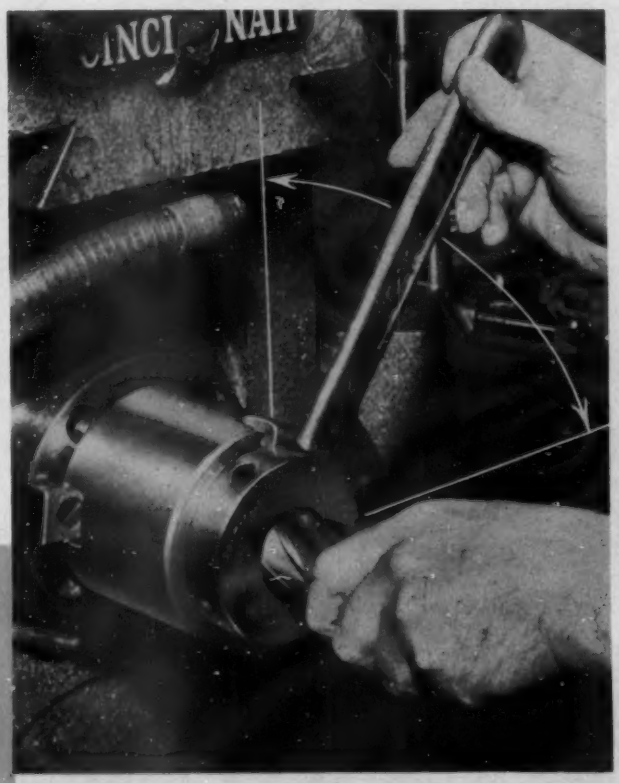
Erickson Tool Co.'s new line of gear chucks incorporates air-operated spring jaws and has interchangeable spring cages for different gears. The cages compensate for composite errors in the teeth and average out pitch-line and run-out.



Dunham Tool Co. turret lathe collet has soft expanding mandrels which can be machined to fit any ID within range of the mandrel. Concentricity after removal and replacement can be assured with truing.



Cushman air-operated chuck is designed especially for use on automatic chuckers. All chuck surfaces are hardened and ground except for soft face and flame hardened ways. Retractable air coupling can be used with either automatically cycled or manual bar feed machines.



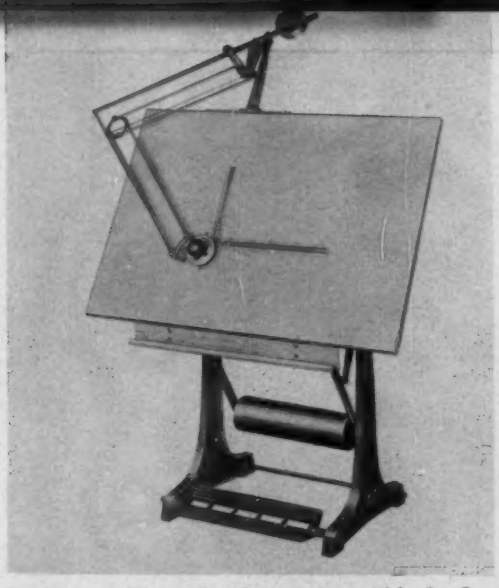
Quick-change Chi-Co collet adaptor permits removal of collets with one-quarter turn of spanner wrench. Two lugs on opposite sides of the collet shank mesh with two corresponding grooves cut at angles in the adaptor wall to guide and draw mating tapers into locking position.

cleaning

Sonogen LG-150 ultrasonic generator is intended for production cleaning of small parts and for experimental work with ultrasonics. Transducer operates at a nominal frequency of 25 kilocycles. Generator is primarily for use with tank type transducers. Branson Instruments, Inc.

Automatic processing of metal parts is provided by washer manufactured by Simplicity Engineering Co. Vibrating action imparts a turbulent agitation to improve washing efficiency. Rate of travel of parts along work carrier is controlled by an adjustment on the vibrating assembly.

drafting equipment

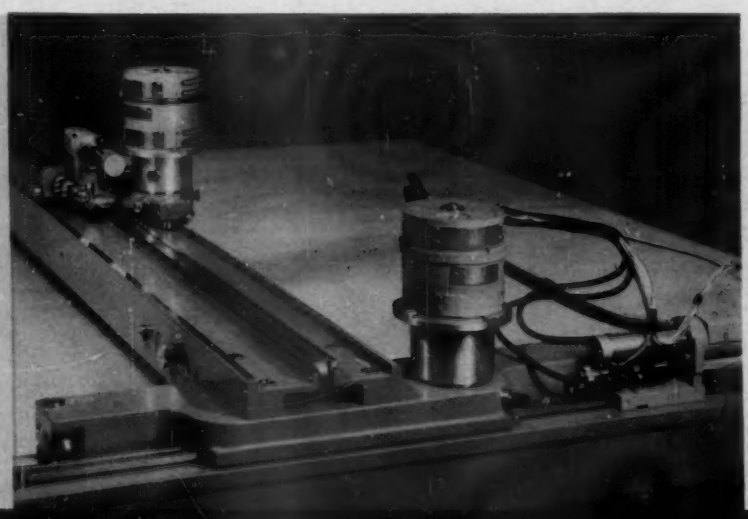


Drafting machine and table manufactured by Isis Inc. combines specially counterbalanced drafting table with a drafting machine. The drafting machine has parallelogram system of arms.

Fluorescent and incandescent lighting are combined in a single reflector on this Dazer floating lamp to blend the good qualities of both light sources on the work surface. Lamp may be used on a machine assembly, inspection bench or desk.

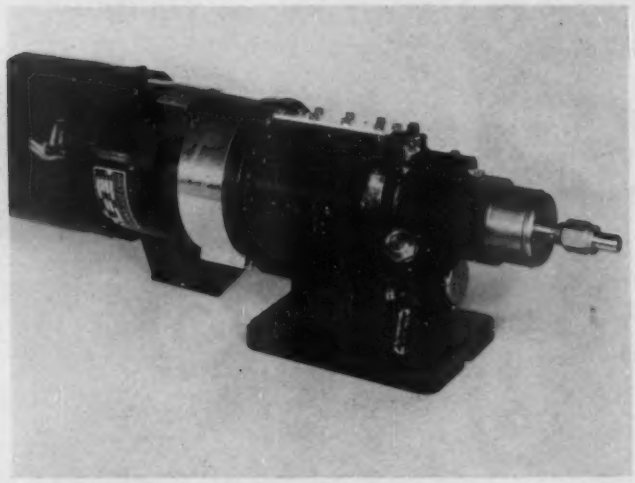
Caddy racks provide a protective mobile file for blueprints, maps and plans and incorporates a foldaway reference table for review of working documents. Plan Hold Corp.

May-O-Matic adjustable drafting table provides for adjustment to counterbalance added weight when lights, drafting machines or straightedges are attached to the table top. A foot lever releases brake to provide a change in height position. Finger-tip action actuates lever controlling tilt. Mayline Company, Inc.

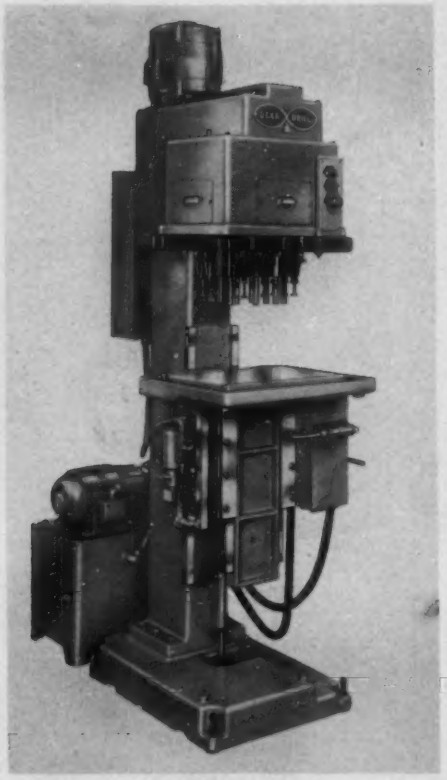


Automated coordinatograph is a point-to-point X and Y plotter designed to function on a directly coupled static system using punched tape or card input. Plotting area measures 47¼ by 47¼ inches. Coordinate positions are read from a visual display. Aero Service Corp.

drilling and reaming



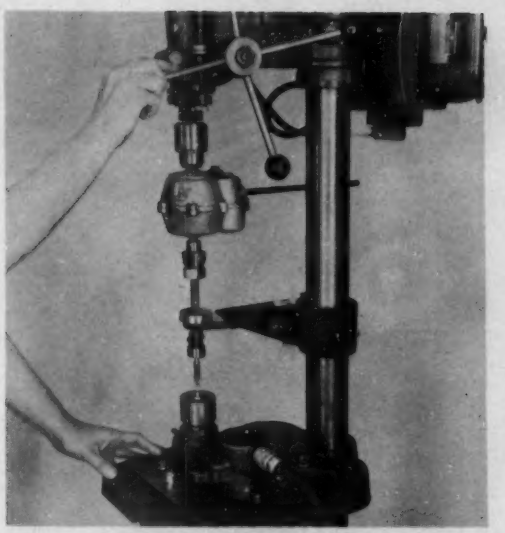
Model KH automatic drilling unit features full hydraulic control, externally adjustable for rapid approach, rate of feed and length of stroke. Capacity is 1/32 to ¼ inch with standard collet chuck, depending on material and drilling conditions. Special chuck is used for tools up to ⅜-inch in diameter for soft materials. Govro-Nelson.



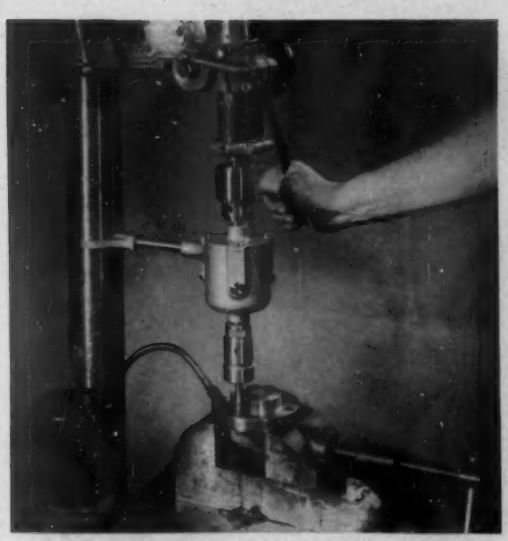
The positioning in this multiple-spindle drilling and tapping machine is simplified by a self-contained, manually operated hydraulic lift which raises the knee by short strokes. To provide rigidity, the ram remains engaged in the slide throughout full travel. Precision Tool & Manufacturing Co.

Reaming cutters which can be easily adjusted for size while locked in the bar are produced by Muskegon Tool Industries, Inc. The reamers have extra-hard, extra-strong adjusting screws with National fine threads. The reamers have full floating action to compensate for errors in alignment.

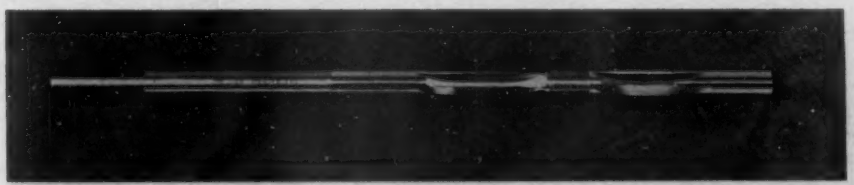
Pressurized coolant is directed through the shank of the tool into angular holes at the ends of each of the flutes in the molded solid carbide tip of these reamers made by Star Cutter Co. Pressurized coolant forces chips ahead of the tool to prevent wedging between hole and tool.



Tapping attachment exhibited by Etteo Tool & Machine Co., Inc., eliminates factor of operator feel in tapping holes. The assembly is provided as a support-arm attachment to any round-column drill press.

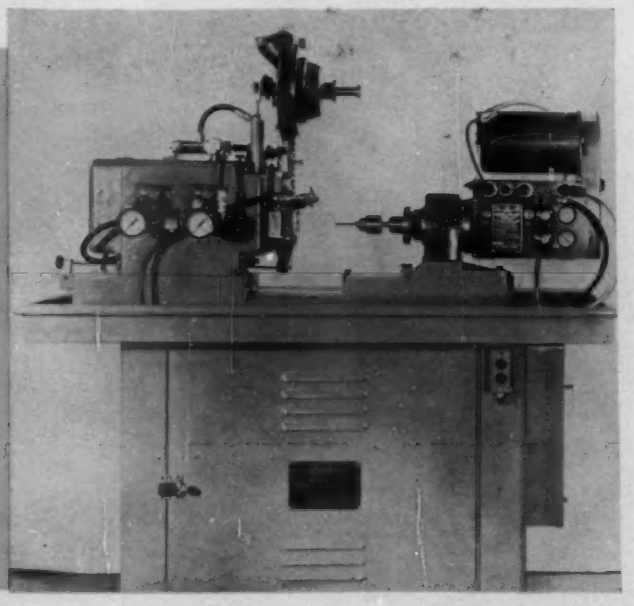


Quick change is feature of Supreme Products Corp. tapping attachment. Called the Versatapper, the unit contains a 4:1 planetary gear reduction system. Tap sizes range from No. 10 through ½ inch.

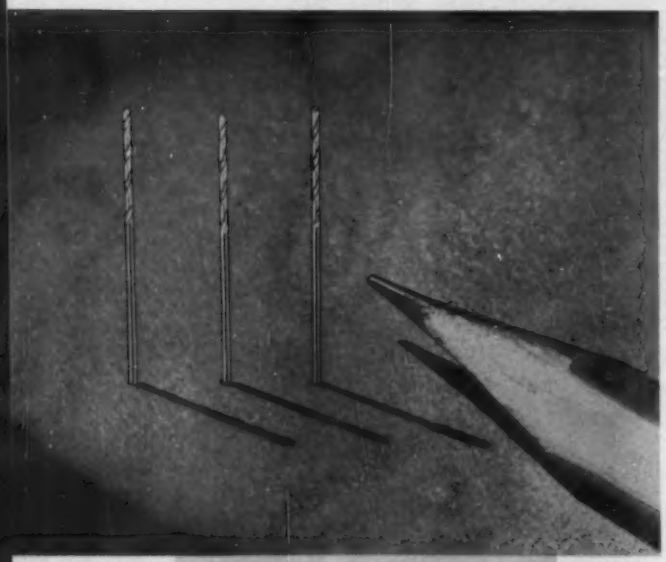


Reducto tool reduces size of oversize holes. As tool passes through work, it first reams to a calculated oversize. The bore is then reduced with a thread extruding section. The hole is finally sized by a finishing reamer section. Besly-Wells Corp.

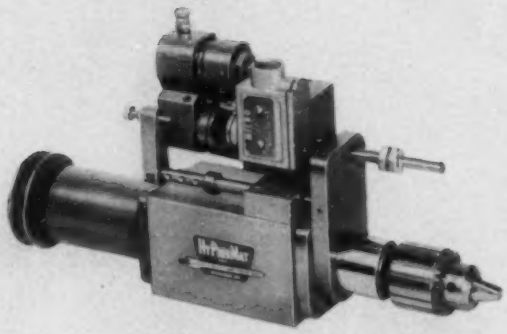
Subland drills with chamfer for drilling and chamfering prior to tapping or other operations requiring a chamfering operation are manufactured by Mohawk Tools.



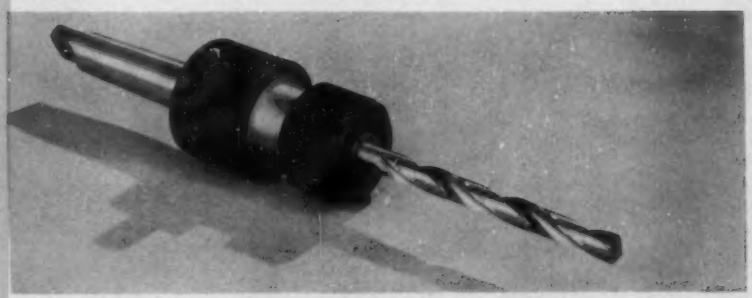
Beco drilling and tapping machine is designed for drilling and tapping of headed parts such as rivets, or for parts with shoulders suitable for axial clamping. Machine is also adaptable to hollow milling, centering, step drilling, countersinking, spotfacing, reaming and certain combinations of these operations. Batchelder Engineering Co.



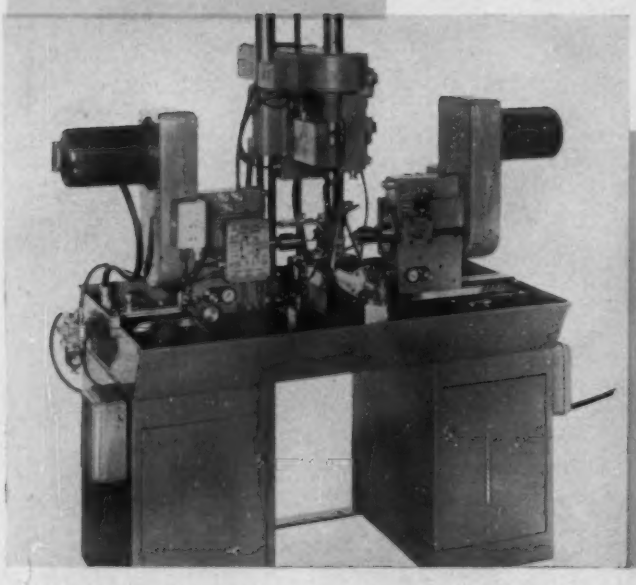
Microdrills manufactured from solid carbide are recommended for drilling plastics, fiber, fiberglass, carbon and other nonferrous materials. Wire sizes range from No. 61 through 80. The Atrax Co.



Standard automatic drilling and tapping units manufactured by Hypneumat Inc., feature all cast iron and steel construction, chrome plate quill, six-splined drive spindle, double-acting cylinder and pneumatic feed with hydraulic restriction.

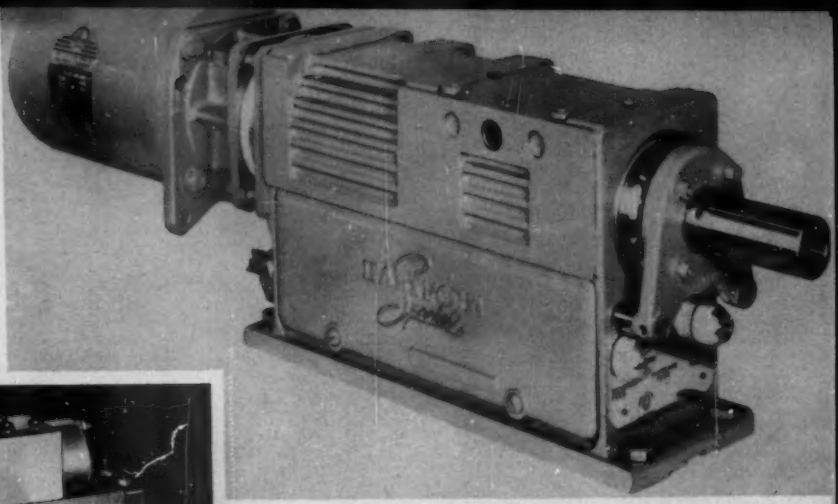


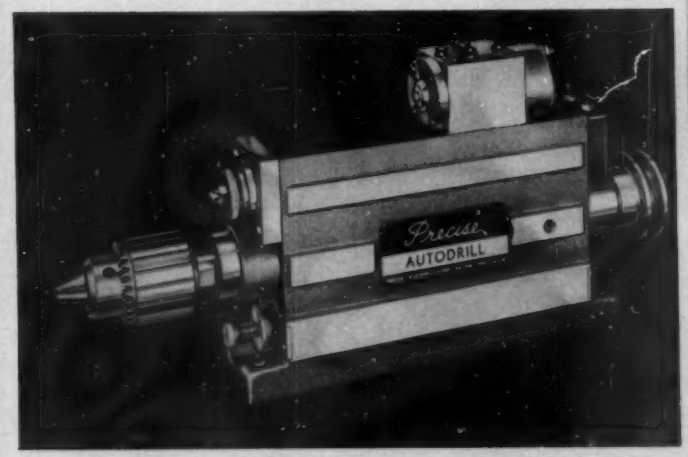
Universal Engineering Co. high-pressure revolving coolant transfer chuck delivers high-pressure coolant to drill tip.



Three-spindle combination drilling machine includes controls that permit operation up to 600 cycles per minute and synchronizing devices that permit use of any type of automatic or semi-automatic transfer, dial index, clamping or positioning fixtures. Machine can be adapted to tapping, threading, hollow milling, deburring or countersinking. Universal-Automatic Corp.

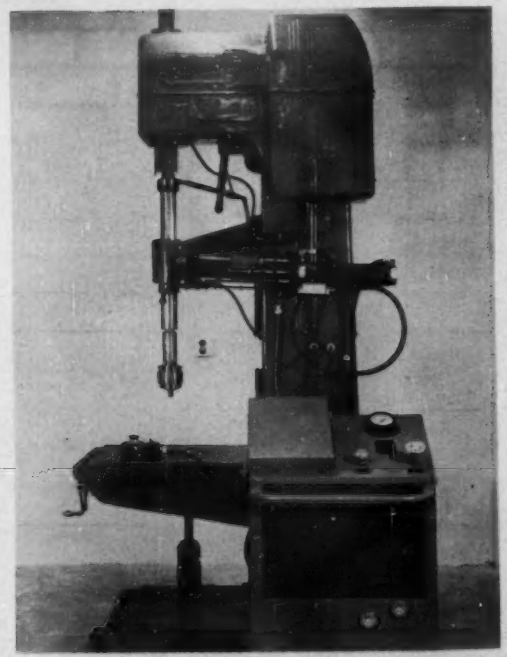
Automatic drill unit for use with standard building block components in automatic production machines are manufactured by Hartford Special Machinery Co. Optional features include provision for backfeed with independently adjustable rate and for skip drilling and dwell control. Unit has integral depth stop and mechanical reversing switch.





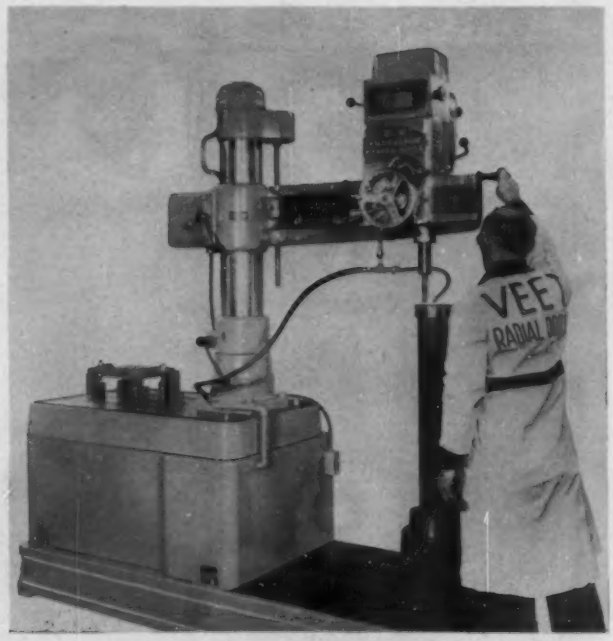
Precise Autodrill is an air-hydraulic unit which is electrically operated with full control of feed and stroke. It can be mounted in any vertical or horizontal position on two-inch centers. Compact, the Autodrill is two inches wide, 12 inches long and seven inches high.

All-gear drive on Boice-Crane Co. drill press allows drilling and tapping on same machine. Substituting gear drive for belts increases hole drilling capacity and allows faster down feeds.



Designed to enable a manufacturer to automate, as well as power-feed, older model heavy-duty drill presses, hydraulically controlled drill press feed consists of a heavy-duty side arm feed transmission and a complete console hydraulic powered pump unit mounted on wheels for portability. The unit has a fast approach and infinitely variable feed speed. Beckett-Harcum Co.

Pin mount core drill has two-piece construction to improve drilling characteristics. Cutting tips can be replaced without removing the tool from the spindle. Metal Cutting Tools, Inc.

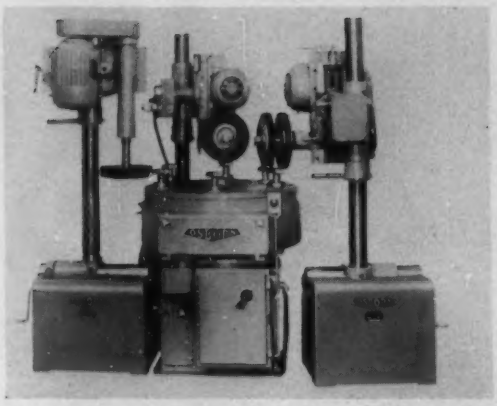


Heavier cast base replaces former fabricated-steel base on the Veet Industries double-end radial drill. The X-member frame is cast into this base with four T-slots draining back into the integral coolant tank. A cabinet base provides space under the drill table for storage of drill vises, fixtures, parallels, chucks and tools.

Operating from shop air line this drilling machine provides a drill thrust of approximatey seven times line pressure. Feed rate is hydraulically controlled and continuously variable. The Electro Mechano Co.

Drillunit is a self-contained hydraulic drilling unit designed to operate as a machine tool component for drilling long holes with a step-and-repeat action. The unit operates on the sliding-dog principle in conjunction with an electric timer to control the number of steps being drilled and the depth of penetration in each step. Drillunit, Inc.

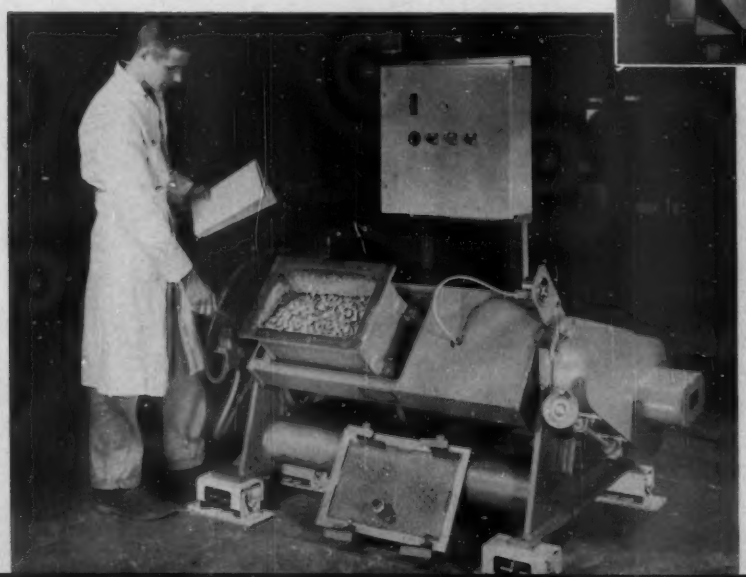
Multibarrel slidehoning machine adds end-to-end motion to conventional roll-over action. Barrels can be mounted individually to process different parts simultaneously. B.M.T. Mfg. Co.



Designed for building-block type assembly, modular components of the Osborn rotary index machine can be arranged to provide fully automatic or manual operation. Osborn Mfg. Co.

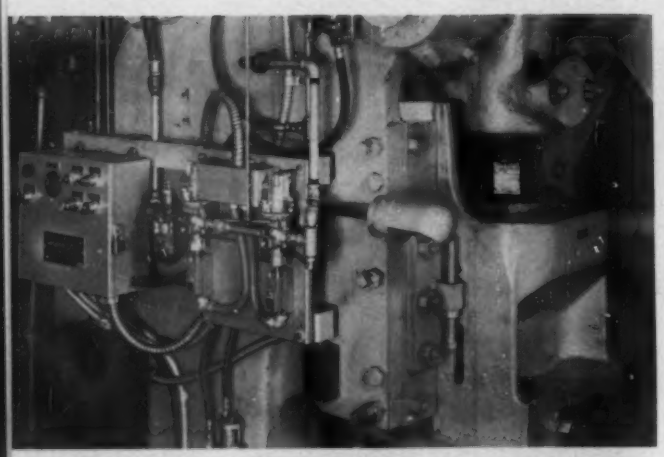
Model 2820 Vapor Blast Mfg. Co. liquid honing machine has one-inch vertical pump and side loading door. Machine is designed for seated operation.

Model VT-72 Vibrasheen vibratory finishing machine is used for deburring, descaling, cleaning, burnishing and surface refinement of metal parts. Almco, Queen Products Div., King-Seely Corp.

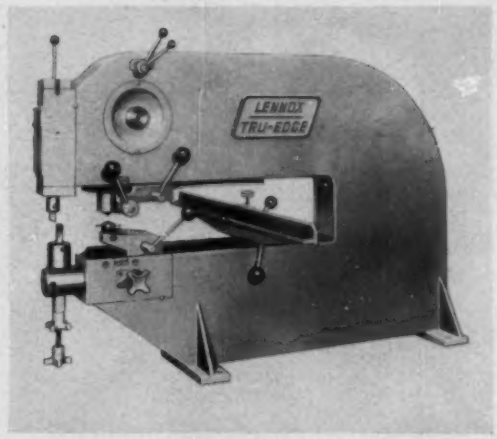


Loreo vibrator employs a three-way vibratory action. Mass within the bowl rotates, and there is relative motion in addition to scrubbing action between the parts and media within the mass. Amplitude and frequency of vibration can be adapted to semiautomatic and automatic processing. Wheelabrator Corp.

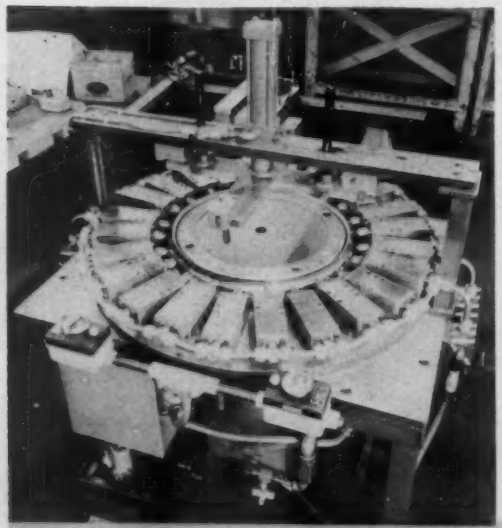
forming, shearing and punching



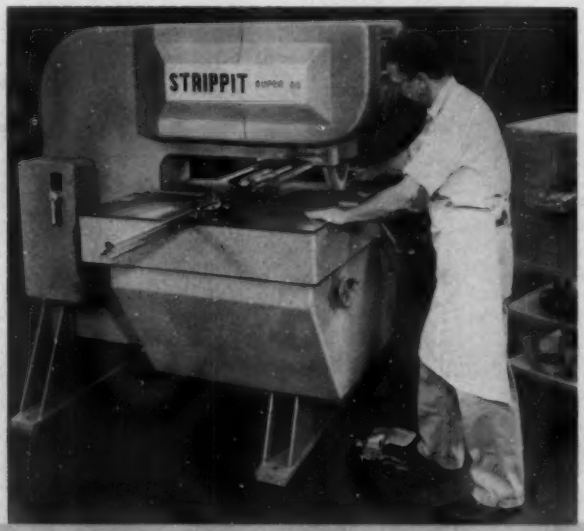
Clutch control manufactured by Fawick Airflex Div., Fawick Corp., is designed for new equipment or for modernization applications on most single-stroke cycling machinery such as presses, shears, conveyors, material handling equipment and automatic lines. Two independent control circuits have separate sources of mechanical motion. Each circuit monitors the other. If a failure occurs in one, the other stops the machine at the top of the stroke and prevents further operation until trouble is repaired.



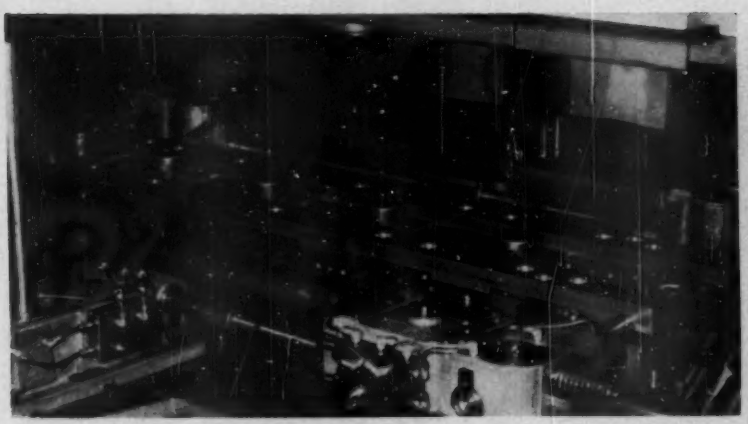
Shearing and forming machine manufactured by Lennox Tool and Machine Builders, Div. of Lennox Industries, is offered for bench shearing, forming and piercing of sheet metals. Stroke length can be adjusted without stopping the motor. Cutting stroke rate from 1750 up through 3500 strokes per minute are automatically regulated according to material thickness when the operator sets the stroke pointer. From 8 to 15 ft of material may be cut per minute.



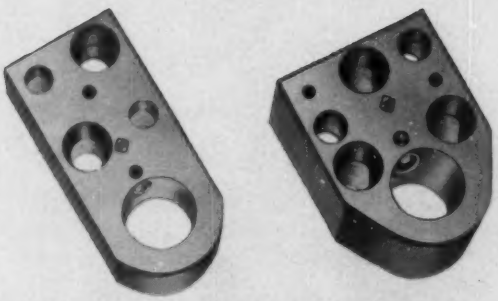
Die-Draulic Grip, Inc., hydraulic piercing units perform piercing, lancing, trimming or clamping hydraulically. When used in a press a master actuating cylinder and piston filled with hydraulic oil, connected to a basic control unit, forces oil into piercing unit connected in the system. Units may be operated in any position. Photograph shows piercing units employed to pierce spoke holes of a bicycle wheel.



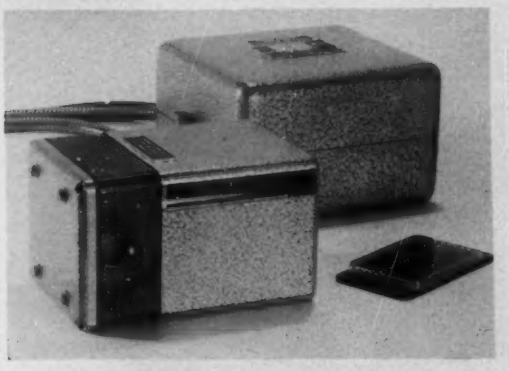
Single-station punch press will handle a 30-inch workpiece of any length utilizing multiple-stop gaging system. Hole punching capacity ranges from 3½-inch hole in 16-gage mild steel to ½-inch hole in ¼-inch mild steel. The machine will do 90 deg corner notching up to 5 x 5 inches in 16-gage mild steel as well as rectangular radii, vee and special shaped edge notches. Wales Strippit, Inc.



Transfer unit manufactured by Livernois Engineering Co. automatically transfers work between press stations. Split type transfer shown has 4-inch finger movement and a 10-inch transfer distance. No stock carrier ribbon is required. Using an air or hydraulic cylinder drive, the transfer unit is suitable for straight-line transfer motion between machining operations such as drilling, tapping, and reaming.



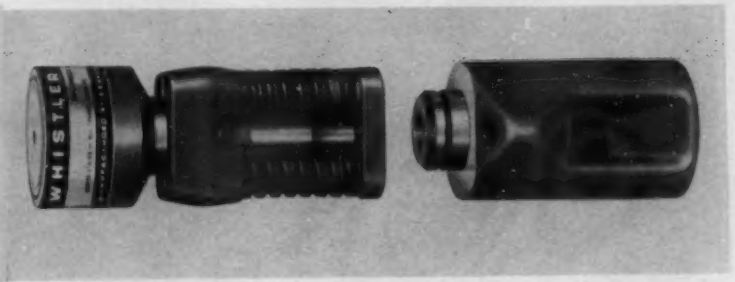
Porter Precision Products retainers are used in dies to hold interchangeable Bal-Lok punches and die buttons. The main feature of the retainers is the built-in puller for easy removal from the dowel pins. Two long jackscrews are inserted in place of the backing plate hold-down screws.



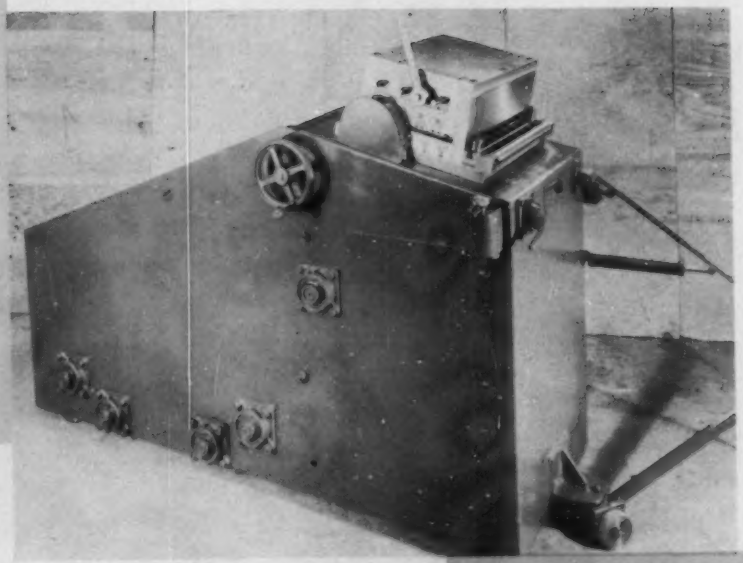
Small parts counter and ejection control was designed specifically for counting extremely small parts without necessity for precise alignment or orientation of the counted parts. Modification of the circuit makes this device applicable to ejection control on small punch presses or forming machines. Presin Co.

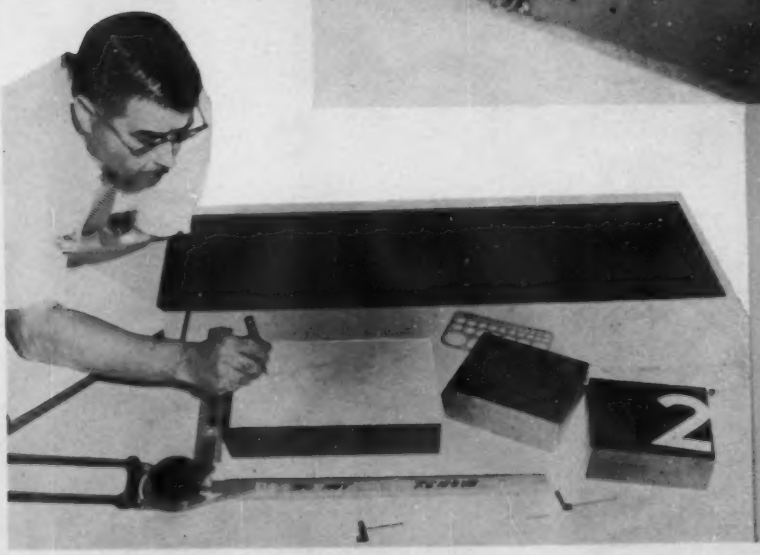
Universal master compound dies manufactured by Hovis Screwlock Co. have key-aligned construction. Interchangeable parts allow manufacture of various size products. Removable parts are held in the die by locating a flat on the insert against a key in the retainer. Multiple dies are also available.

Punch and die retainer units for Magna-Dies have been decreased in over-all size thus allowing more holes to be punched in one operation in many instances. Magnetic perforating punches and dies are now stocked in 0.001-inch increments from 0.100 through 0.500 diameter with larger sizes available. S. B. Whistler & Sons, Inc.

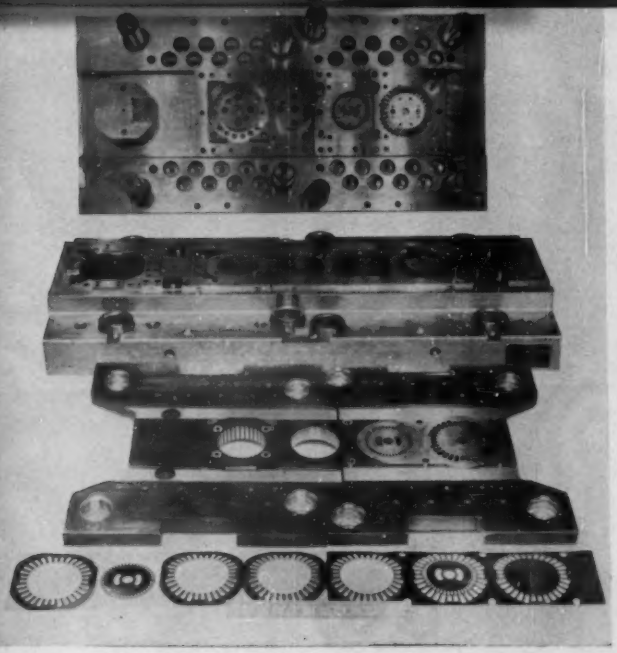


Combination coil cradle and stock straightener will hold up to a 6000-lb coil. Loop control, reversing switch and side-plate rollers are standard equipment on all models of this equipment made by Durant Tool Supply Co.

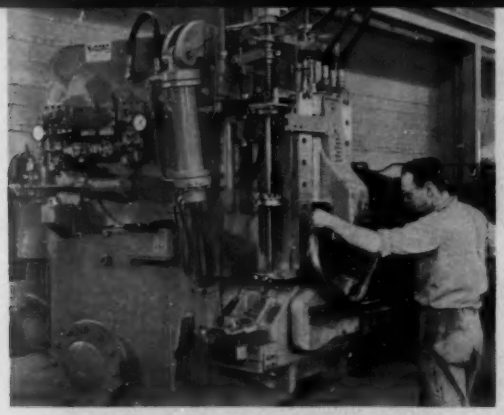




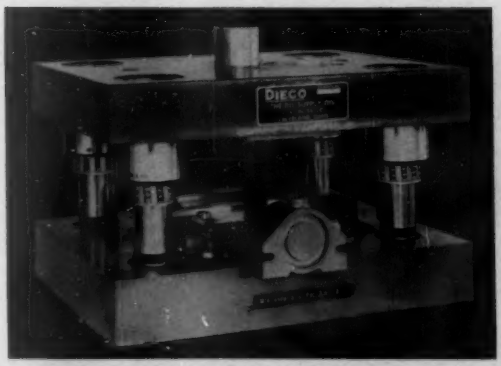
Diemaking process where most metal is removed by drilling instead of kellering is claimed to reduce die costs by the patent holder, Pay-Les Die Div., Payne Tool & Engineering Co. After layout and drilling, additional stock is removed with endmill drilling. Dies are then broached. Following broaching the punch or die is ground back to provide clearance.



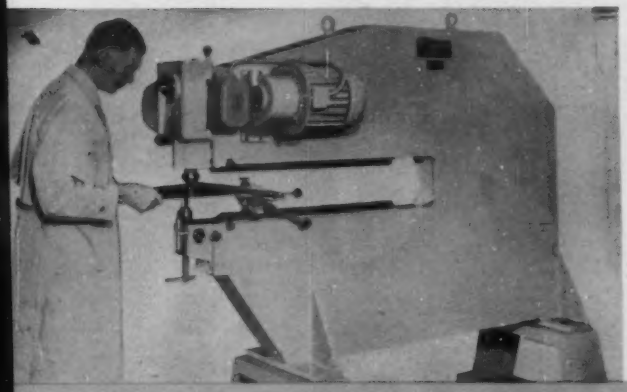
Steel and tungsten carbide lamination dies are manufactured by Commando Tool Co., Inc. Dies are usually progressive although many laminations, especially extremely precise ones or those which are extremely large are produced on compound or progressive-compound dies. Stampings produced by these dies are used in the electrical industry.



Tube bending press built by Pines Engineering Co., Inc., has capacity of 30 tons. The press performs progressive bending of work requiring different angles and varied bend planes. Steel tube 3-inch OD by 0.125 wall or laminated tubing up to 2½ inches in diameter can be handled on the machine. Bend angles are controlled by ten-station, automated indexing angle-of-bend selector.

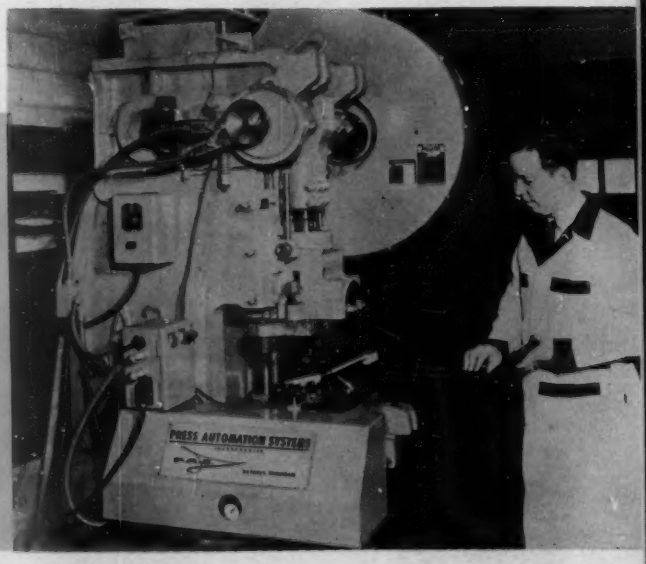


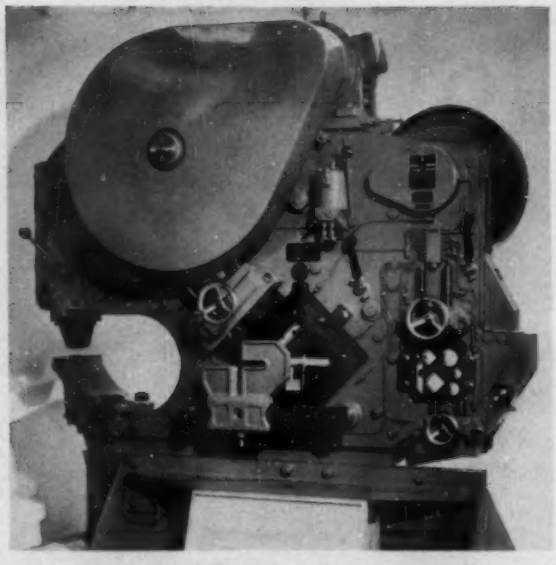
Angled slots in the bearing retainer on E. W. Bliss Co. ball-bearing die sets offset each ball by four degrees to prevent vertical rows of ball bearing from tracking. Stepped projections in the retainer prevent sudden shock when load is suddenly applied.



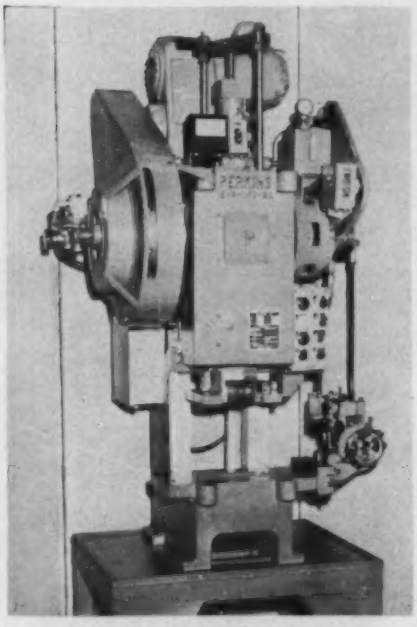
Pullmax Model P-7 universal sheet and plate working machine can be used for straight, circular and irregular cutting of mild steel in thicknesses up to 9/32 inch. The machine will also do inside square cutting, slot cutting, nibbling, louver cutting, beading, joggling, edge bending, flanging and dishing. American Pullmax Co., Inc.

Secondary operations parts feeder for presses manufactured by Press Automation Systems, Inc., transfers parts by means of vacuum, magnetic or gripper fingers. Part is lifted from a preload station, transferred into the die nest, or over gage pins, and on the return stroke the press is tripped. The part is automatically ejected while pickup arm is cycling.

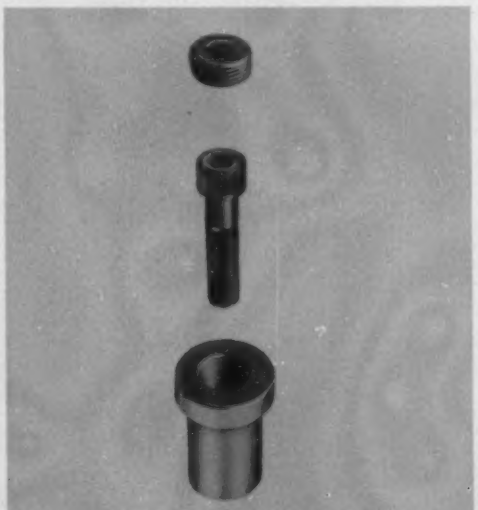




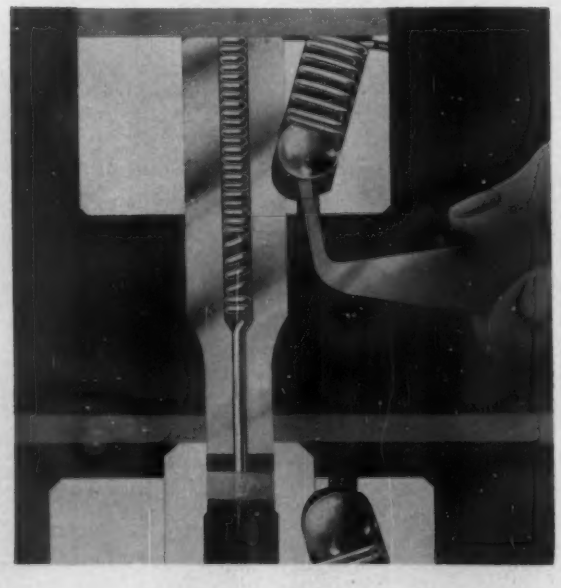
Peddinghaus universal steel worker is especially suited for fabricating structural steel products. The machine is used for a shearing plate, coping and angle and tee cutting. Square or round bars may be cut without modification of the machine. Upton, Bradeen & James, Inc.



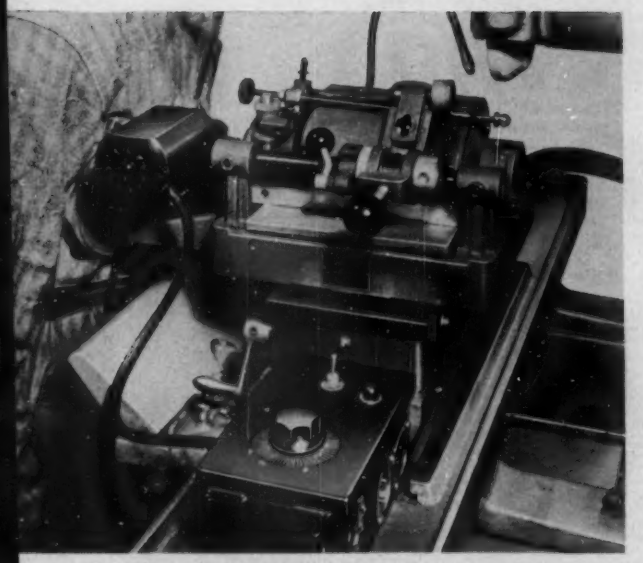
Perkins Machine Co. Model 158 power press has speeds from 200 to 600 rpm. Crankshaft stroke is adjustable. Speed variation is remotely controlled; tachometer indicates speed. Machine has air clutch and brake, self-locking ram, adjustment with power drive, and automatic lubrication.



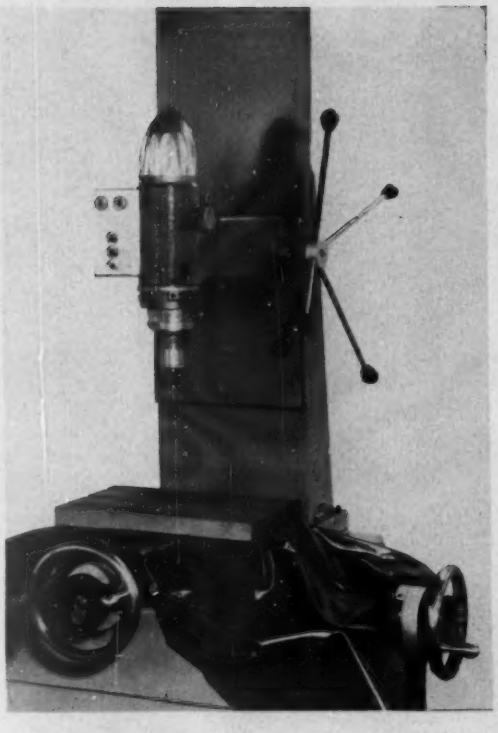
Die pad retainer supplied by Harco Engineering consists of a hard steel sleeve with indent pin, alloy steel socket head capscrew and lock screw with national fine thread. The lock screw prevents the capscrew from becoming loose under constant vibration and pounding.



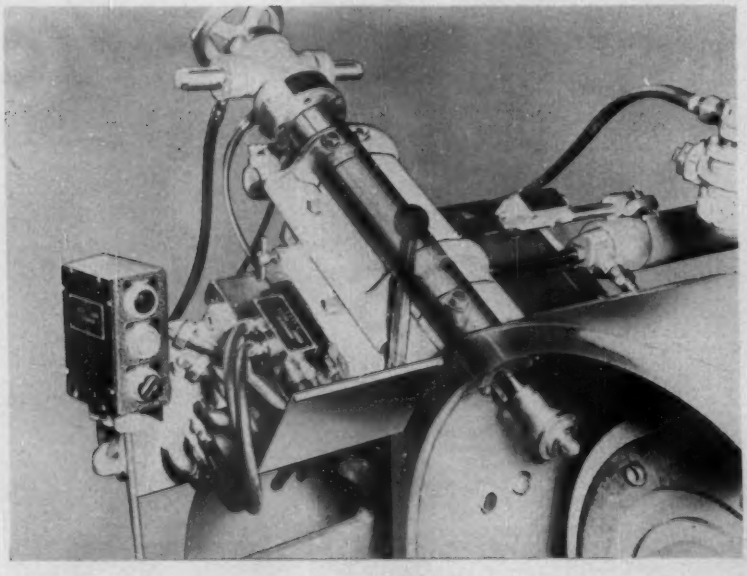
Slug-Shedder punch, manufactured by Richard Brothers Punch Div., Allied Products Corp., eliminates slug pulling. A coil spring mounted in the punch and extending 3/64 inch beyond the punch point compresses on down stroke. On upstroke spring pushes slug from punch.



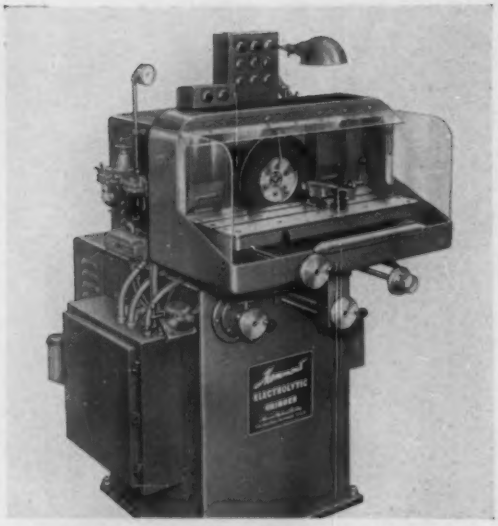
Motorized fixture enables through-feed or form grinding operations to be performed on cylindrical parts with conventional surface grinders. The device utilizes an outside diameter drive and adjustable roller clamping for concentricity. Products Supply Co.



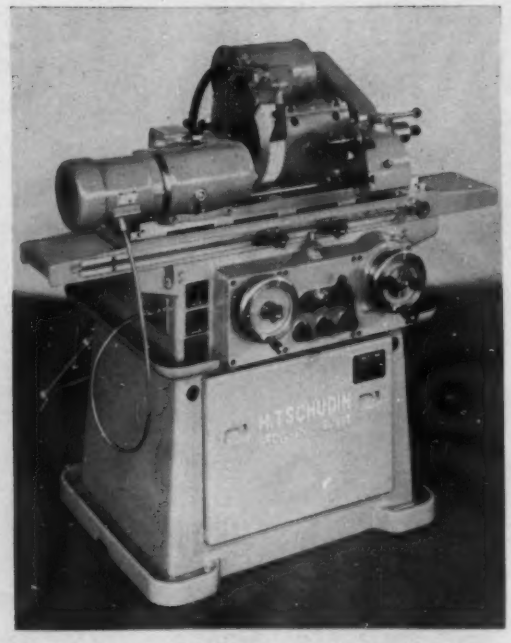
Jig and contour grinder offers direct reading dials, power feed to head and pushbutton control. Grinding spindle is air driven. Speeds are variable on stroke, workhead and grinding spindle. Diamond Die and Mold Co.



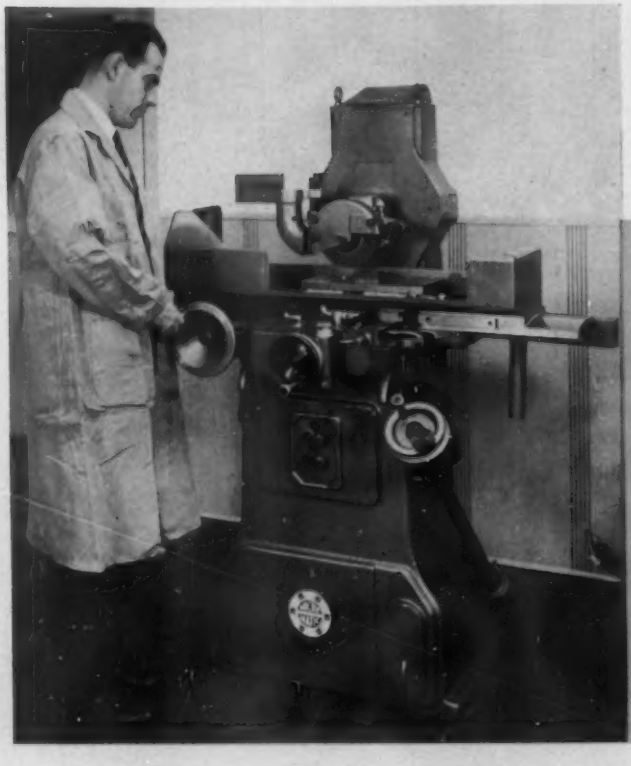
Automatic dresser keeps diamonds sharp by turning them hydraulically. Coolant and feeding of the dresser barrel into the wheel for rough and finish dressing are controlled hydraulically. Amount of dress and dressing rate for both rough and finish dress is adjustable. Cleveland Industrial Tool Co.



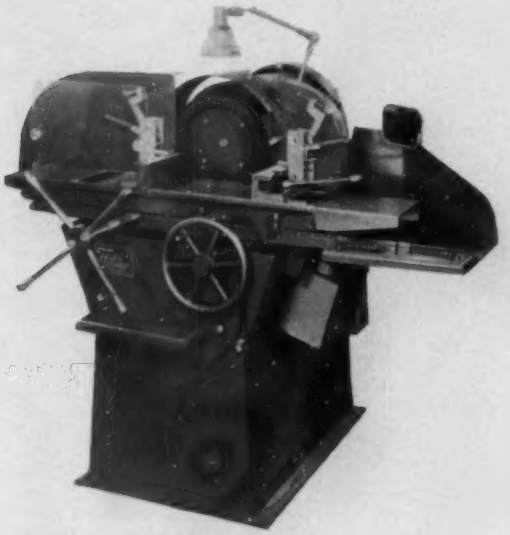
Hammond model EG-10 oscillating electrolytic grinder has 12 by 29-inch table, including wings. The table can be tilted with a hand wheel from 10 to 20 deg below horizontal with no movement toward the wheel. Table structure is mounted on ball-bearing ways and is fed in by air. In-feed can be reversed at any point.



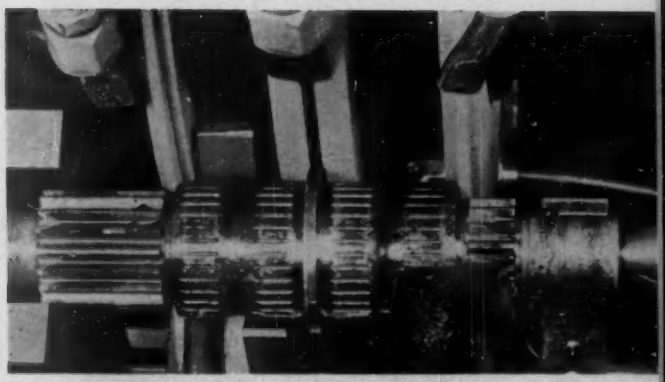
Cylindrical grinding machine manufactured by Tschudin Machine Tool Works is specifically designed for production and single-workpiece grinding where rapid change in setting is required. Additional equipment for the machine, such as internal grinding headstock, internal grinding attachment, profiling devices, and collet operating attachment can be provided. Alina Corp.



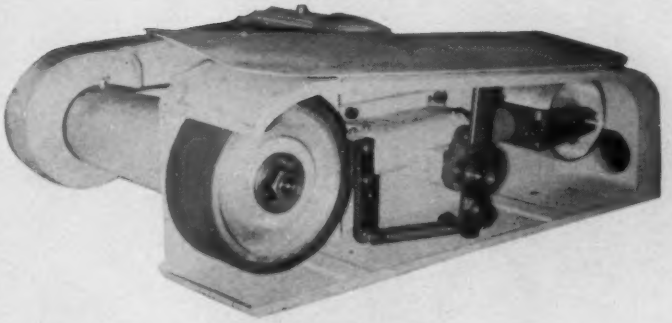
Hydraulically operated surface grinder has variable table traverse rates from 5 to 40 fpm, hand-controls for both traverse and cross-feed, micrometer adjustment for crossfeed and vertical adjustment of wheelhead. Wheelhead slide operates on ball-bearing rollers running on ground bars to provide sensitivity. Micromatic Hone Corp.



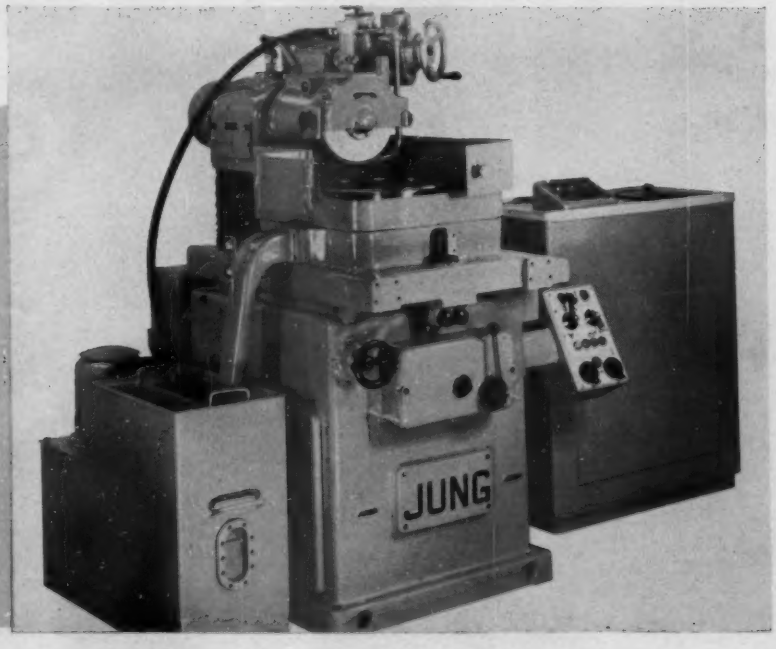
Workpieces are fed to a grinding wheel of a Thiel facing machine as work is fed to a face mill on a horizontal milling machine. Squaring and clamping blocks speed operation. Wheel runs at 1400 rpm. Eastown Tool and Engineering Co.



Koebel Diamond Tool Co. CDP cutter is a rotary cutting tool with numerous diamond particles held in a metal matrix for forming grinding wheels. Cutter is brought under power to a grinding wheel running at full speed. Gang cutters may be used to simultaneously form grinding wheels. Wheel dressing may be intermittent or continuous.



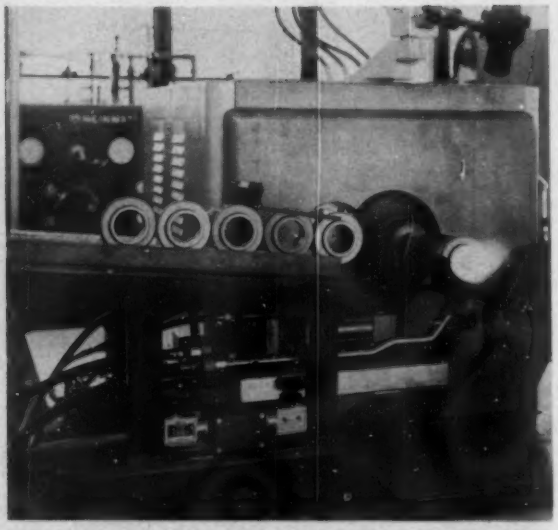
Lathe attachment may be mounted on lathes, planers and various other machines when abrasive belt grinding is required. Designed to operate in horizontal, vertical or angular positions, the unit mounts a 12-inch rubber faced contact wheel. Wheel spindle is of tapered nose design in a cast housing. Production Machine Co.



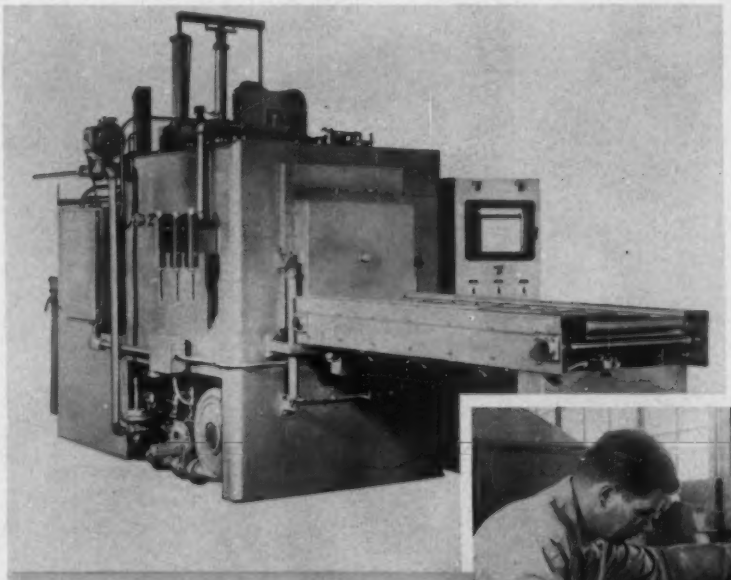
Jung Model H-30 rotary table surface grinder has automatic five-step grinding wheel down-feed for rough and finish grinding. Used to best advantage in high-quantity production grinding, this machine can also be equipped with an electromagnetic circular chuck with two or three exchangeable pole plates. Speed of the rotary table is variable between 50 and 100 rpm. International Machine & Tool Corp.

heat treatment

Induction-heating generator control station has panel type construction permitting access for maintenance from one side only. Modular dimensioning permits incorporation in automatic system. Tocco Div., Ohio Crankshaft Co.



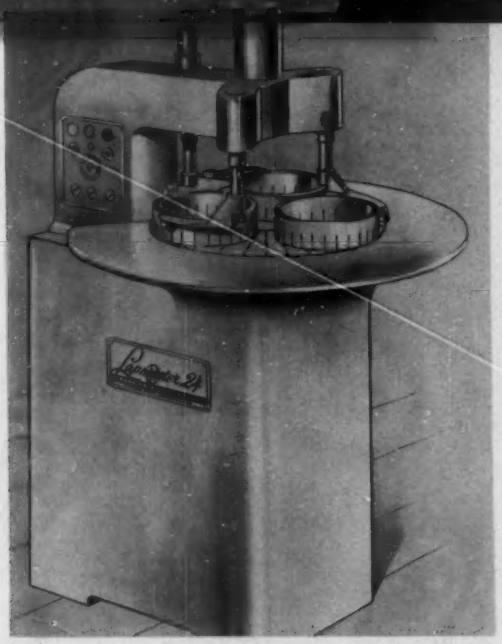
Developments on this Flamatic heating machine include a water-cooled rotary flame head which spins within the area of the part to be heated and a gas-control cabinet for jobs requiring a low-volume gas flow. Heating cycle is automatic. Pilot lights and safety flame detector insure flame-out protection. Cincinnati Milling Machine Co.



Automatic enclosed-quench, batch type heat treating unit is capable of carburizing, carbonitriding, bright hardening and other operations in a protective atmosphere with an enclosed quench or cooling cycle. The latest model of this unit manufactured by Hevi-Duty Electric Co. has a shortened loading table with no loading or transfer mechanism located in the heating zone.

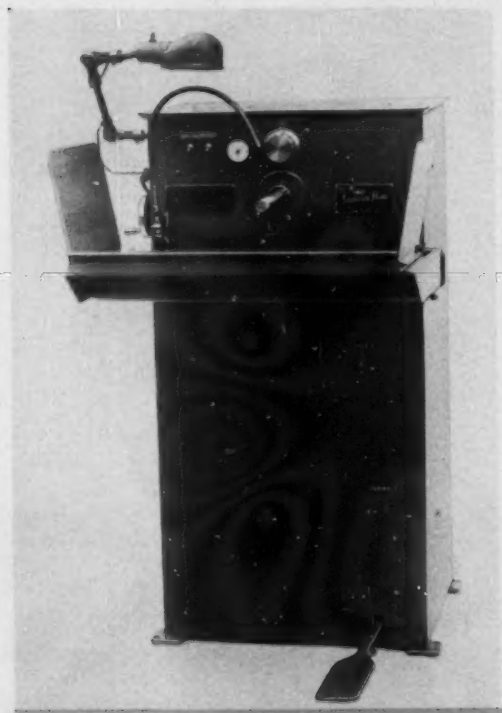
Protective atmosphere for heat treatment of high-carbon, high-chrome and high-speed steels is created within the furnace work chamber in this electric furnace manufactured by The Sentry Co. Atmosphere requires no adjustment or special skills.

honing and lapping

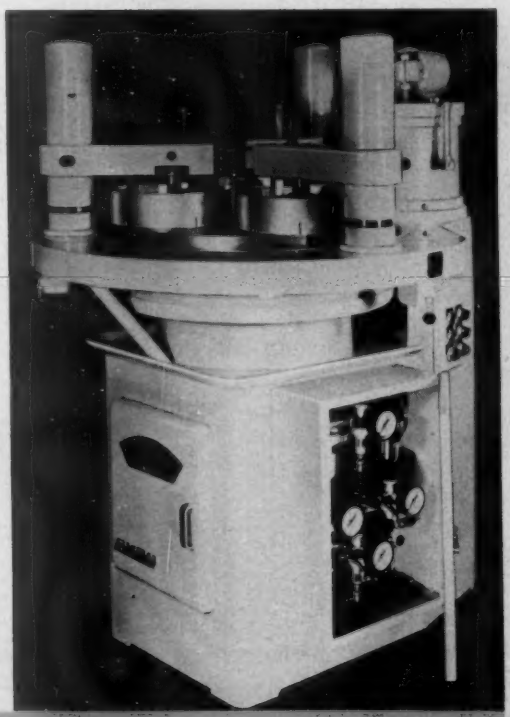


Electromechanical control on Lapmaster lapping machine automatically checks and maintains lap plate flatness. Sensing head detects errors in trueness. Conditioning rings are shifted to compensate for wear pattern on wear plate. Crane Packing Co.

Adjustable shoe mandrels for honing bores with keyway splines, ports, etc., are manufactured by Sunnen Products Co. Sizes are for 1⅜ through 2¾ ID. Larger sizes are available on order. Replaceable bronze alloy shoes are adjustable to conform to the curvature of hole surface. Eccentricity adjustment provided on each mandrel shank compensates for possible runout over entire homing range.

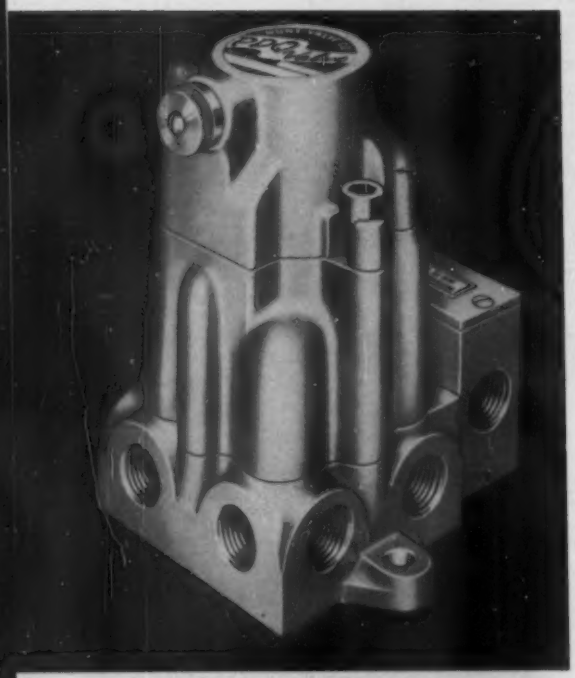


Honing machine designed for production runs, toolroom works and salvage operations is offered by Superior Hone Corp. Model J2 provides infinitely variable spindle speeds from 225 to 525 rpm on an optional range of 450 to 1050 rpm. Features are tray top, sealed ball-bearing spindle, splash guards and anti-splash screen.

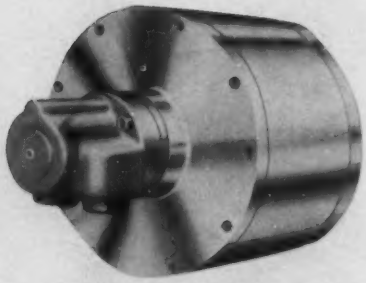


Spitfire 24-inch Gyro-Matic flat lapping machine has pneumatic lifts to control pressures on downstroke and upstroke. Adjustment valve controls lifting of rings and weight pads from lapping plate. Safety device prohibits machine operation when one or more of the lifting arms are in up position.

hydraulics and pneumatics

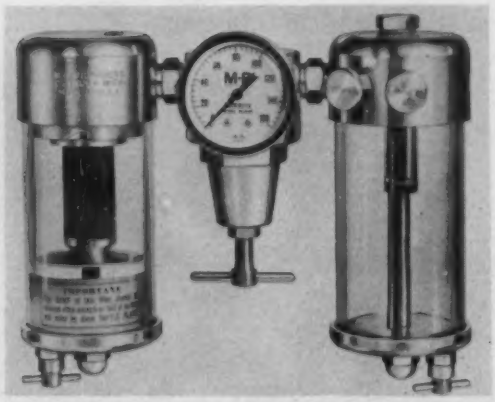


Solenoid directional control 4-way air valve is air-pilot operated. The valve has a short stroke pilot to actuate a full-orifice poppet spindle. With ½-inch pipe connections the valve will flow 335 cfm at 100 psig initial pressure to atmosphere. Hunt Valve Co.



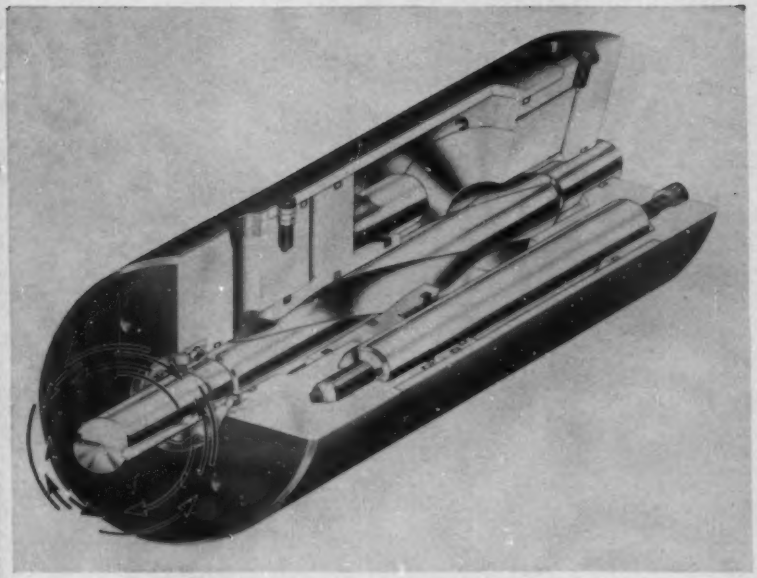
Model RM rotating air cylinder, built by The S-P Mfg. Corp., is designed for use at speeds up to 3600 rpm to actuate rotating holding devices.

Air and hydraulic piston cylinders manufactured by Bendix-Westinghouse Automotive Air Brake Co., have non tie rod construction, utilizing integral castings for cylinder heads and mountings. Internal locking key design provides flexibility of mounting and mounting arrangements.

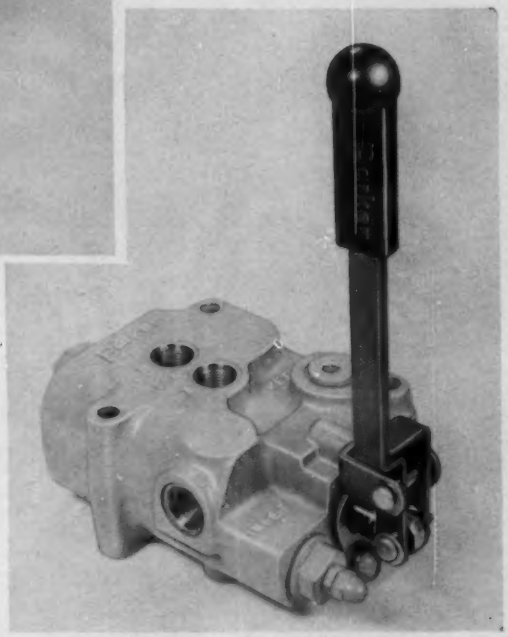


Airline filter, regulator and lubricator assembly manufactured by M-B Products, Inc., is used for protection of air valves, cylinders, controls and pneumatic tools. Ribbon type filtering element functions on the edge filtration principle, to remove solids 10 microns and larger. Oil is metered into airline from bowl of lubricator by means of a sight drop feed indicator tube. Volume of feed is controlled by a needle valve.

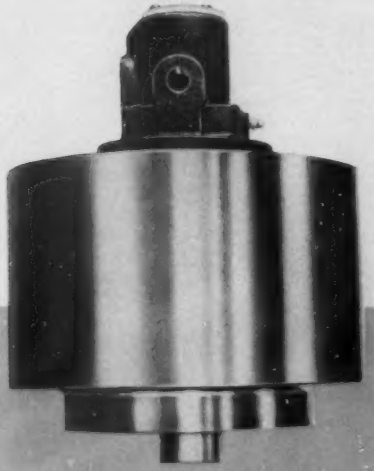
Pacer series of air valves manufactured by Ross Operating Valve Co. has cast aluminum housing. Models include 3-way, 4-way manifolded and pilot-head models. Model shown weighs 28 ounces.



Rotary actuator made by Carter Controls, Inc., has full cushioning as standard in providing 0 to 370 deg of high-torque rotation. Powered by air, gas, water or oil, the actuator may be stopped at any point in the rotation cycle. Applications for this actuator include positioning, indexing, cam actions, swing motions, progressive turning, clamping, rolling and lifting.

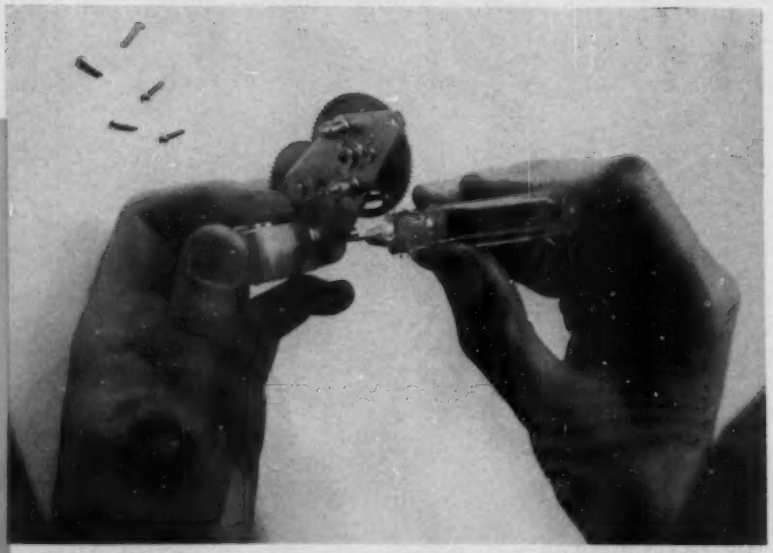


Single-spool hydraulic directional control valves (right) manufactured by Parker Hydraulics Div. of Parker-Hannifin Corp., are 3 position with "tandem-center" usable either 3-way or 4-way. Valve has an integral check which prevents load drop when changing spool operating positions; also an integral relief valve, externally adjustable from 800 to 1250 psi or from 1600 to 2050 psi, depending on spring.

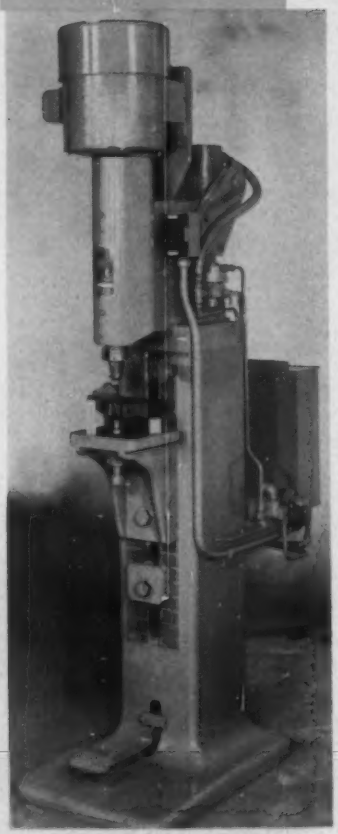


Logansport Machine Co. hydraulic cylinder is designed for actuating various workholding devices that are mounted on a rotating spindle. Cylinder is manufactured in 7 sizes ranging from 3-inch bore to 14-inch bore. Piston strokes are up to 2 inches. Maximum operating pressure is 500 psi.

Push-pull self-sealing couplings, manufactured by Aeroquip Corp. allow quick connect and disconnect of hydraulic lines. Pushing on sleeves effects connection; pulling back sleeve releases connection.

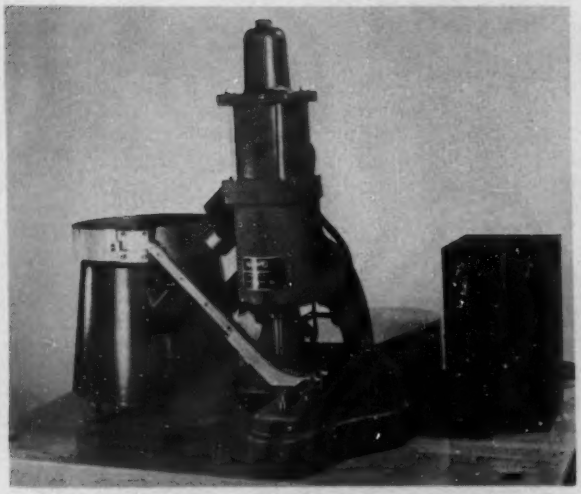


Miniature socket screws manufactured by The Bristol Co. are applicable to the assembly of precision parts used in electronic and airborne equipment. Head dimensions for these screws meet new standards. New socket dimensions make possible higher tightening torques.

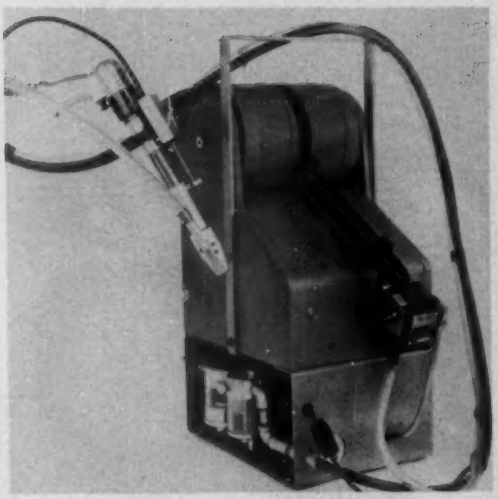


Machine for noiseless spinning of rivets, pins, studs, hinge pins, closures and beads features adjustable spinning pressures, time cycle and spindle height. Precision Detroit Co.

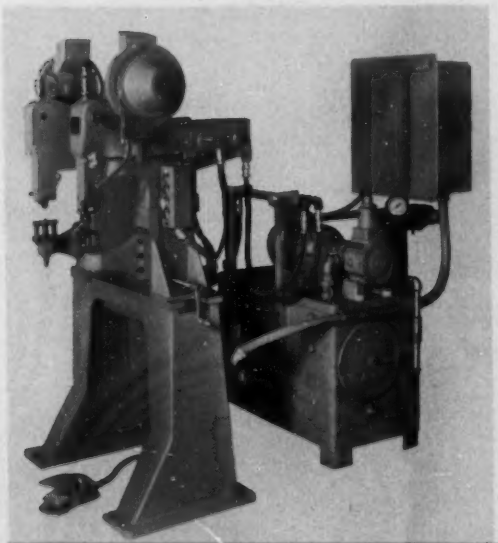
Designed to handle up to 2500 setscrews per hour, this unit can serve either as an attachment to a single machine or as a building block in a completely automated production line. Called Setomatic, the machine automatically feeds, inserts and tightens hexagon socket setscrews to predetermined torque. Standard Pressed Steel Co.



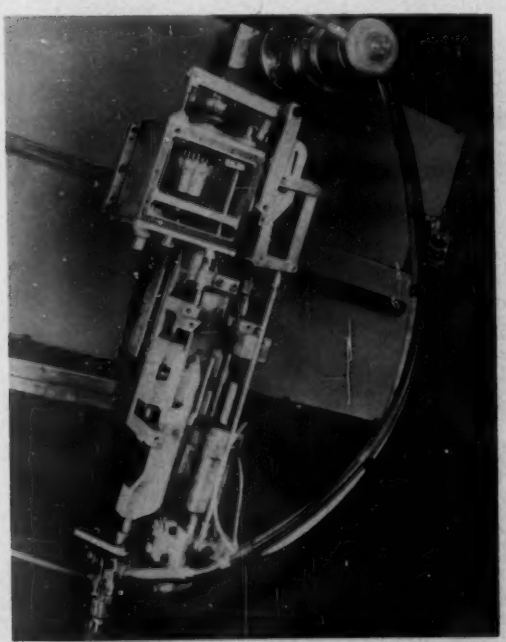
All-electric terminal setter is capable of orienting, feeding and setting up to 100 terminals per minute. Use of a track to carry terminals from bowl to the escapement permits wider range of terminal sizes. Operation by a foot switch leaves hands free. Black & Webster, Inc.



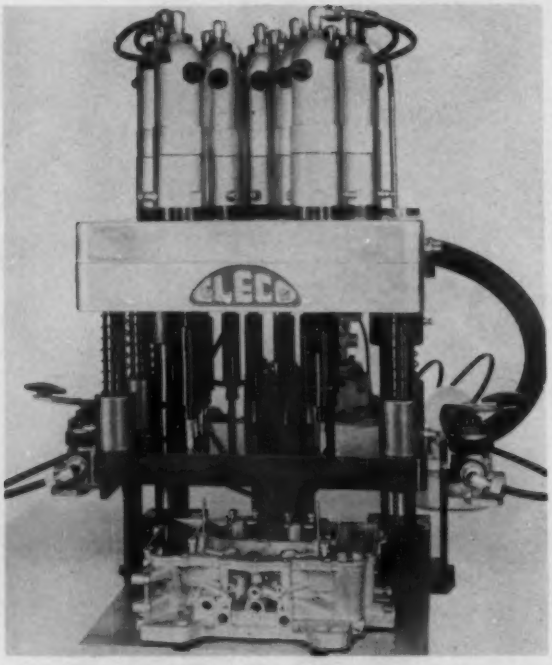
Tru-Tork automatic screwdriver system feeds fasteners through a flexible tube of an air blast. System consists of a power screwdriver, hopper feed and a plastic feed tube. Clyde Engineering and Mfg. Corp.



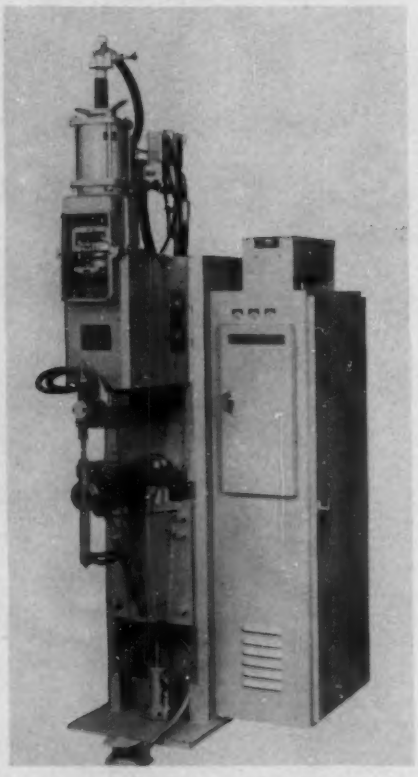
Tompkins-Johnson Co. hydraulic riveter can be tooled to feed and set two ¼-inch-diameter solid steel rivets at one time. Throat depth is 8 inches, and the machine has adjustable rivet spacing from 1½-inch minimum to 18-inch maximum center to center.



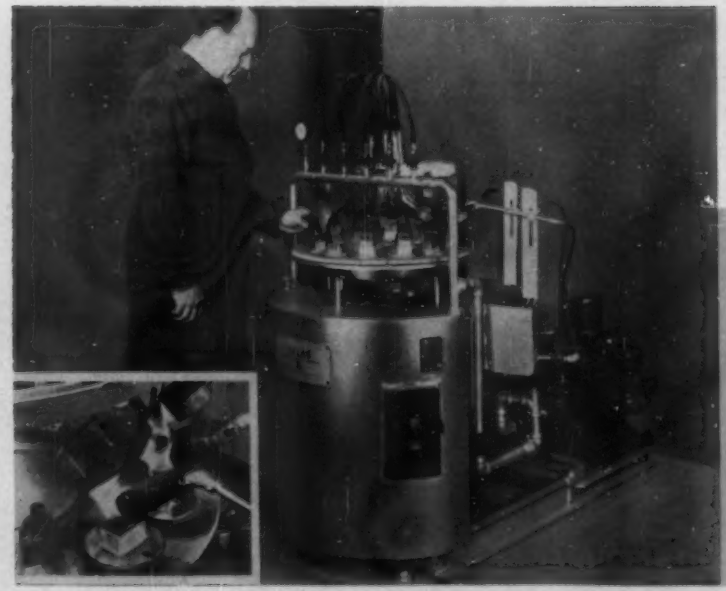
Mechanical follower tracer welding system developed by Expert Welding Machine Co. permits automated welding operations on untrimmed, out-of-tolerance, straight-line or contoured edges. Welding head carriage follows the contour of the parts by means of cams. A mechanical probe connected to a tracer system follows the actual weld contour line in the part. The difference or error between the design contour and the actual contour is then transmitted to a mechanical memory unit where it is temporarily stored. This information is transmitted to the welding torch, which is then correctly positioned on the actual weld line of the part.



Self-contained twelve-spindle screw setter automatically cycles after operator momentarily depresses thumb valves. Unit lowers to work, finder plate contacts part, spindles run screws down to stall torque, and motors stop. After two-second pause, unit raises, ready for next assembly. Cleco Air Tools.

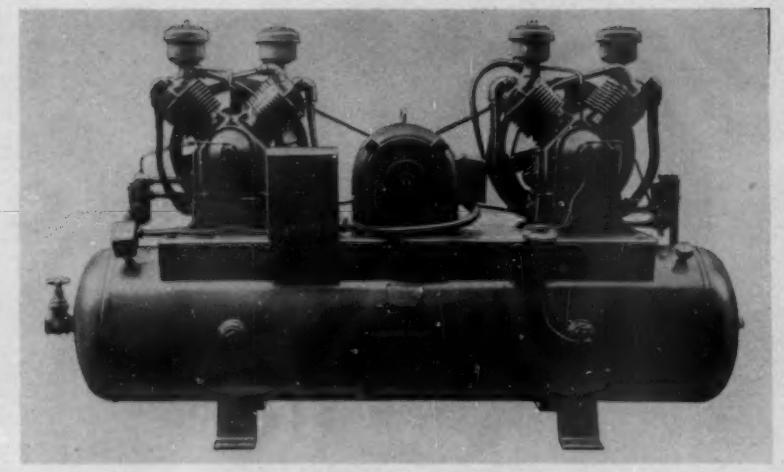


Air-operated RWMA size 1 press type resistance welder for both spot-welding and projection welding operation, is manufactured by Taylor-Winfield Corp. Machine has controls for automatic pulsation welding.



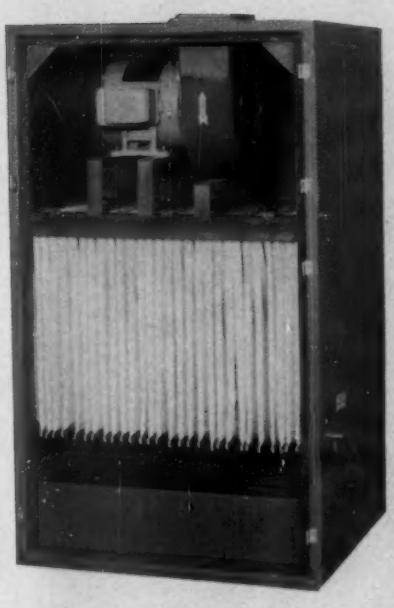
Selas Corp. of America Superheat burners produce high heat release for brazing. Flame temperatures up to 3000 F and blast velocities to 2500 fps can be produced. Burners use commercial fuel gas and air.

machinery accessories



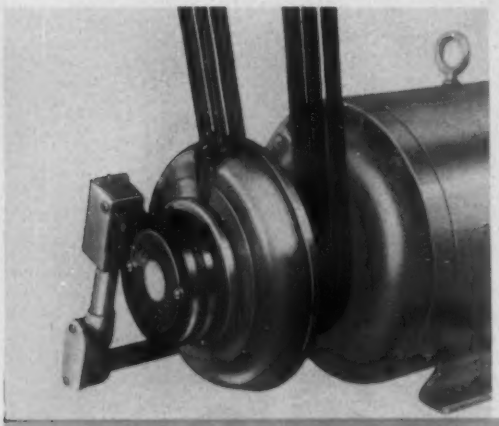
Compressor incorporates two model RE-36 pumps driven by a single motor. Compressors have 120-gallon tanks and are equipped with magnetic starters. Maximum working pressure is 200 psi. Displacement is 76 cfm at 100 psi, 63.4 cfm at 200 psi for the 15-hp model and 96 cfm at 100 psi and 80 cfm at 200 psi for the 20-hp model. Champion Pneumatic Machinery Co.

Line of motorized gear reducers built by Doerr Electric Corp. utilizes motors with Nema type C machined face construction, making motor separable from unit.

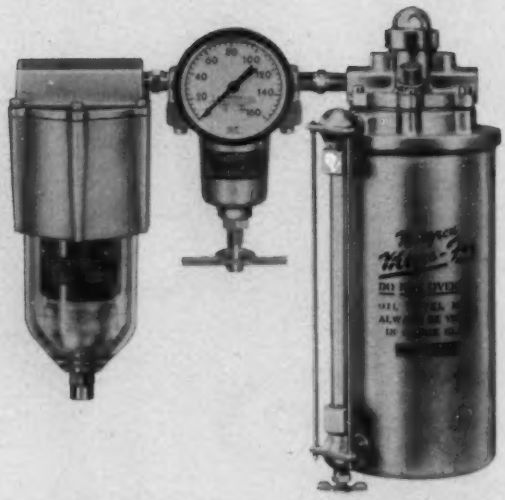


Torit Mfg. Co. dust collectors are self-contained and range in capacity from 160 to 2000 cfm. Air passes through cloth filters to remove particles as small as one-half micron in size.

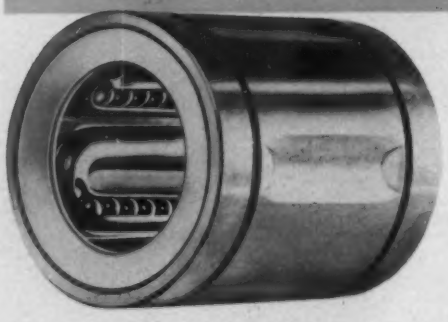
Pneumatic machinery mounts are capable of maintaining level under varying load conditions. As load on a mount increases a corresponding increase of the air pressure in the mount compensates to retain level. Column air pressure is controlled by a valve in height adjustment screws. Barry Controls Inc.



Cyclesheave is a packaged assembly incorporating an electromagnetic clutch with a bearing-mounted sheave for shaft mounting on stub-shaft extensions on motor or reducer shafts or for belt-driven equipment. Cycledynamics Inc.

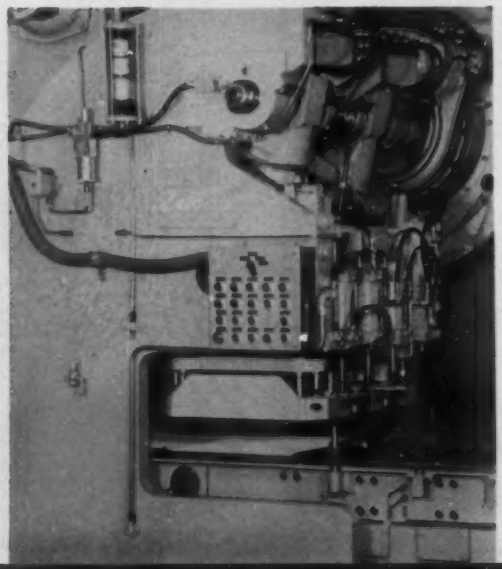


C. A. Norgren Co. Micro-Fog central lubrication unit supplies lubrication for Kearney-Trecker Milwaukee-Matic. The device furnishes lubrication to all parts except the spheroid reduction gear. It is automatically synchronized to machine operation.

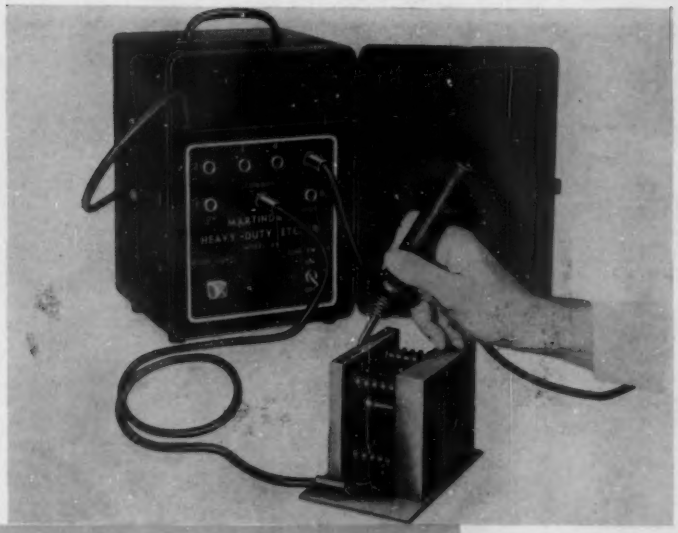


Ball-bearing bushings are used on guide rods, reciprocating shafts and for push-pull action. Sizes cover a shaft diameter range of ¼ to 4 inches. Thomson Industries, Inc.

Mounting for control of vibration or shock has specially-processed high-density molded fiberglass materials encased and bonded with neoprene. These industrial machine mounts are manufactured by Consolidated Kinetics Corp.



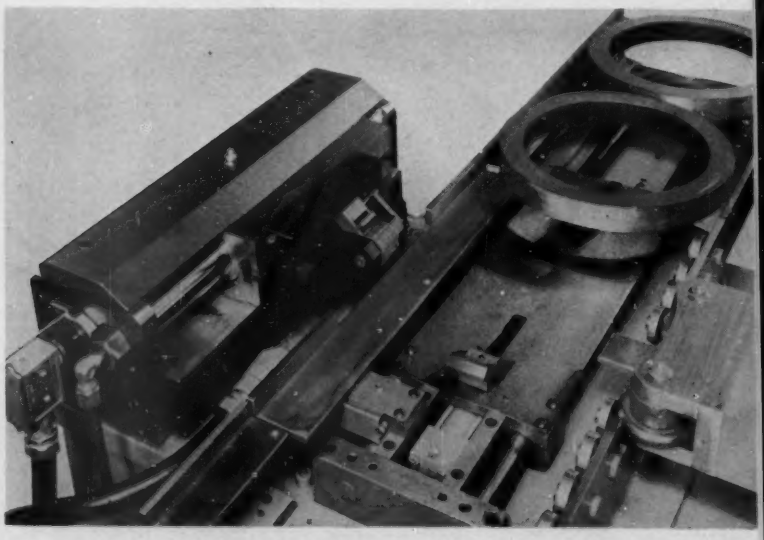
Trabon Engineering Corp. type M systems are piston type dividing devices which proportion lubricant discharged by a pump to the bearings of a machine. Feed sections, each containing a metering piston, are manifolded into distributor assemblies to serve groups of bearings. Progressive type operation provides that operation of each metering piston depends on previous pistons functioning properly.



The Martindale Electric Co. model A-M heavy-duty electric etcher is designed for constant use in production. Heat taps are taken from the secondary winding of the transformer. Heats range from 180 to 1375 watts.

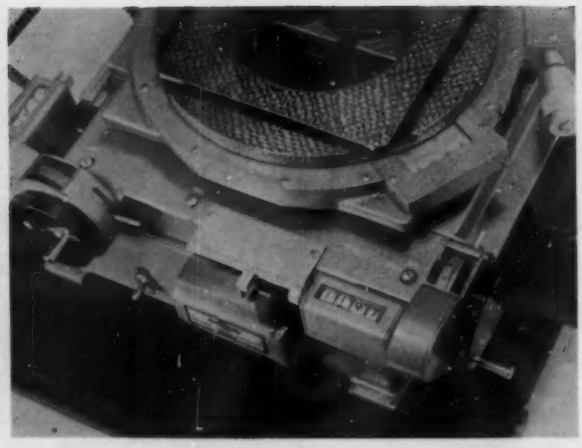
Semiautomatic rotary table electrochemical marking machine manufactured by The Electromark Corp. can mark parts at the rate of about 50 per minute. Device is air-operated. It can be hand fed and unloaded or automatically fed.

Pneumatically operated general purpose roll marking machine marks round or flat workpieces at speeds up to 1500 pieces per hour. Noble & Westbrook Mfg. Co.



Horizontal hydraulic marking machine built by Geo. T. Schmidt, Inc. is designed as a completely self-contained in-line marking station. When parts are marked with consecutive serial numbers, each successive number is indexed automatically on the return stroke of the die slide.

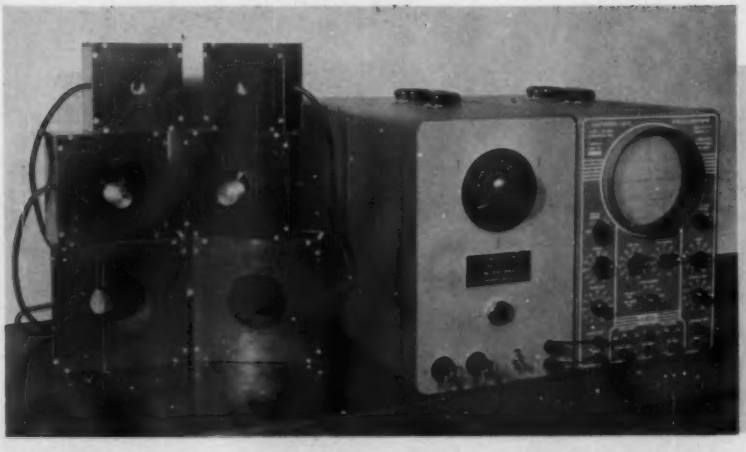
measurement and inspection



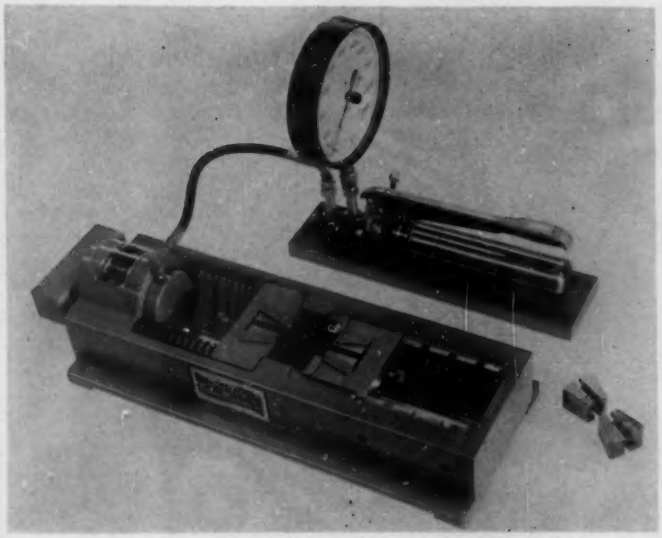
Geared drum counters for toolmakers' microscope make it possible to read coordinate position of the stage directly from counter drums, rather than adding scale, drum and vernier readings. Counters are manufactured by Gaertner Scientific Corp.

Planekator manufactured by Rahn Granite Surface Plant Co. can be used to calibrate surface plates, machine ways or other flat surfaces without calculations. Rahn also manufactures granite surface plates, angle plates, parallels and straight edges.

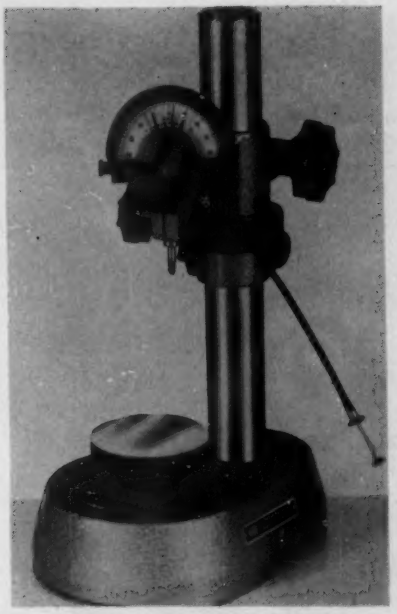
Height gage manufactured by Challenge Machinery Co. combines functions of both height checking and height measuring. Gage has a micrometer scale. Units are available in sizes up to 120 inches.



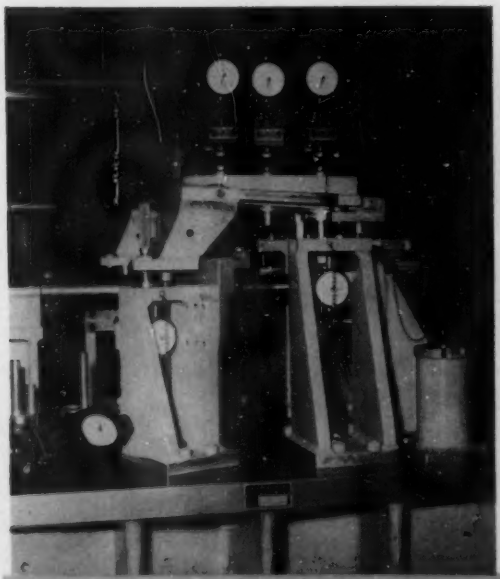
Oakland magnetic checker is used for sorting, testing and detecting flaws in parts or metal specimens having magnetic properties. By comparing against a reference sample, pieces which are visually identical may be sorted with respect to chemical composition, heat treatment, residual stress or physical differences. Electro-Mation Associates.



Portable tensile testing machine manufactured by Steel City Testing Machines Inc. has a capacity of 40,000 lb. It is hand-operated, bench mounted, and is designed for portability. The unit can be wall mounted with the pump and gage unit on a bench.

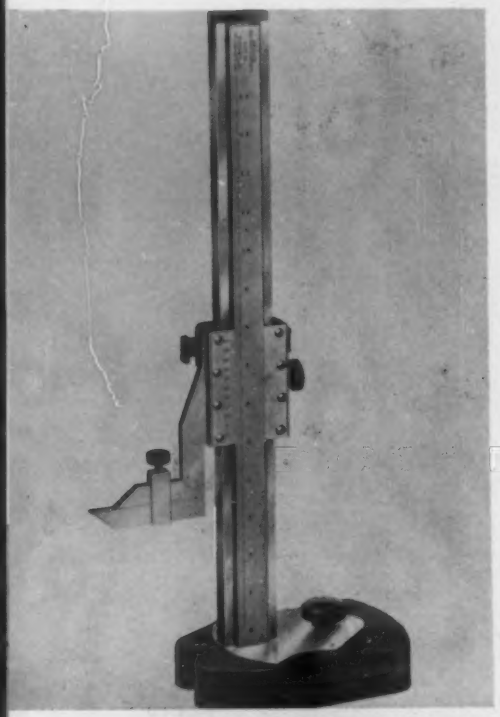


Mauser dial indicator has a cable release attachment for raising the contact point. The instrument has tolerance hands for setting tolerance limits with a fine adjustment which must be engaged in order to zero-in the indicator. Scherr-Tumico Co.



Sweep concentricity and hole relation gages manufactured by A. G. Davis Gage & Engineering Co. are used in conjunction with specially designed master fixtures to check hole location and other hole and surface relationships. Expanding centralizers can be adapted to the gages to check concentricity from one hole to another or squareness of a surface to a hole.

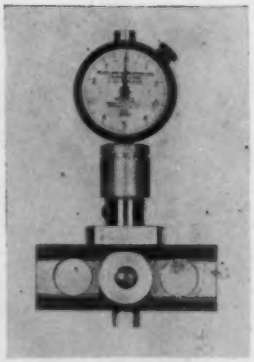
Portable balancer manufactured by Stewart-Warner Corp. can be used for balancing equipment such as blowers, fans, pumps, turbines, rolls, motors, engines, drive shafts, generators, machine tool spindles, gears, couplings and chucks. The instrument is adjustable from below 10 millionths of an inch to over 1/10 to ⅛ inch amplitude of vibration.



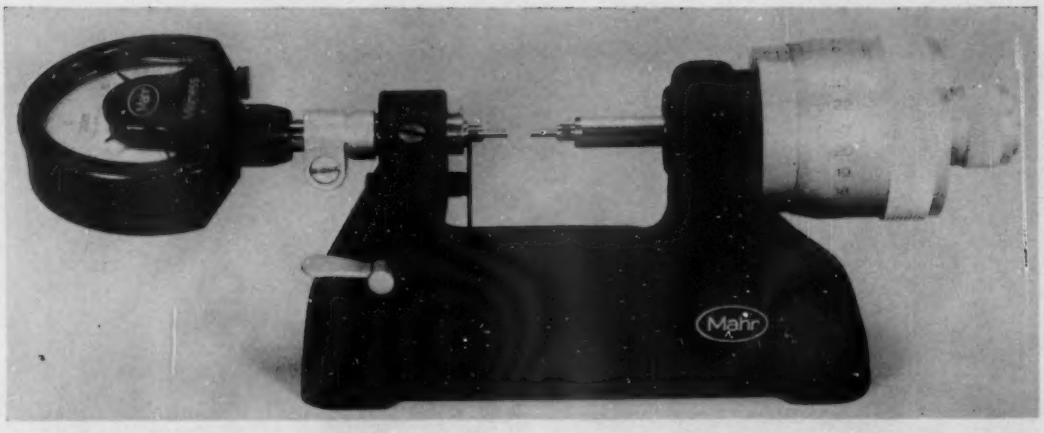
Vernier on this master height gage made by L. S. Starrett Co. has 50 graduations for easy reading. Fine adjustment knob is contained in the base on sizes up to 24 inches. On larger sizes, fine adjustment is on top of bar. To eliminate parallax, vernier is flush fitted.

Sheffield air-gage recorder automatically records plus or minus deviation of part size from nominal on a 4-inch wide chart during gaging. It can be used with back-pressure air gage tooling such as open-jet, ball-jet and blade-jet spindles, as well as air snaps, air rings and Plunjet gaging cartridges.

Mechanical amplifier on the Laurel Corp. amplifier-indicator gage assembly multiplies all readings five times. The dial indicator and amplifier are mounted on flush-pin gages.

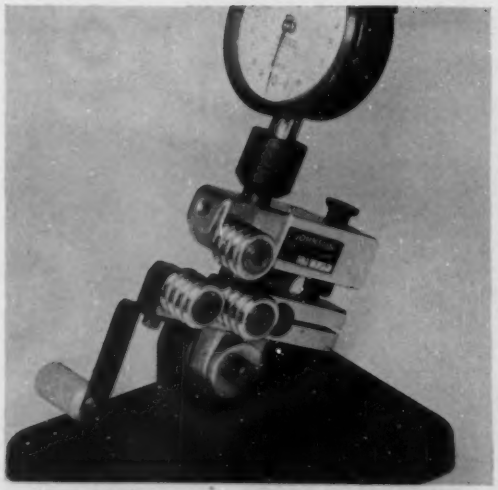


Thread gages to measure Acme threads or 60-deg threads up to 20-inches pitch diameter are manufactured by Alameda Gage.

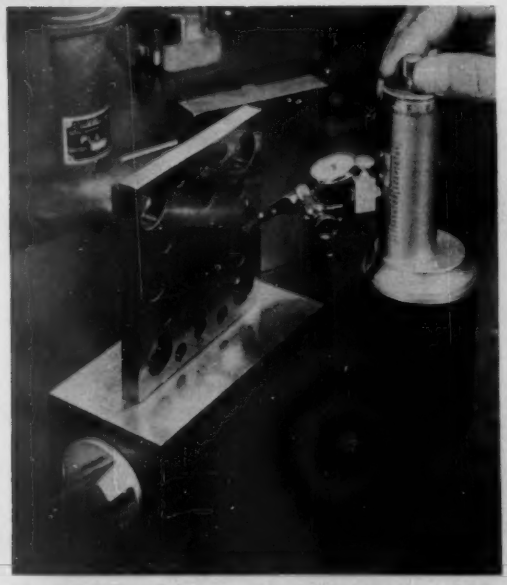


A nonrotating spindle has been employed for the Mahr Gage Co. super comparator bench micrometer which is designed for the measurement of small delicate parts. Indicator reads directly in 20 millionths of an inch. Throat depth is 1.280 inches. Eleven different measuring angles are available.

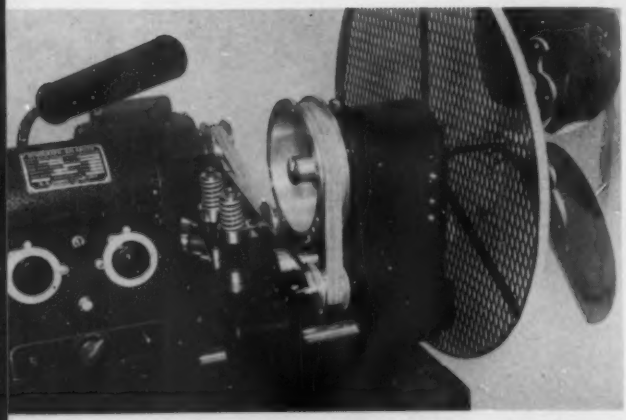
Air lift on angle block manufactured by The Herman Stone Co. allows the operator to guide the heavy block into position with light pressure. The block floats on a cushion of air while being moved from one position to another. Air is piped into a hole in the back of the block and led to a series of grooves on the bottom surface. The grooves are located so that the air will escape if the block is moved too close to the edge of the surface plate.



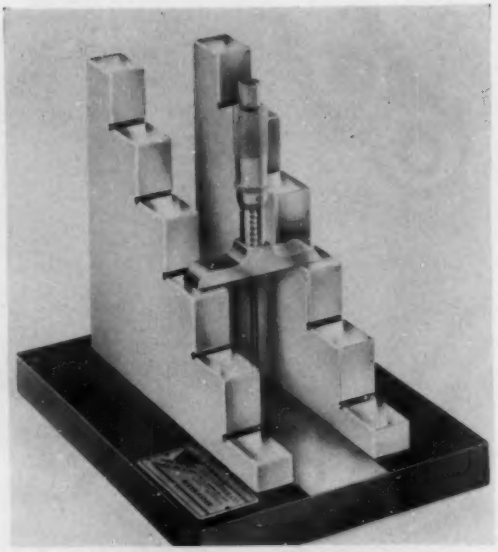
Model C-3 Tri-Roll thread comparator comes in sizes from No. 0 through 1½ inches. Rolls of various pitches can be interchanged on different sized frames. The same set of pitch rolls can be used on several thread sizes for NC, NF and NEF, or for any thread either right or left hand. The Johnson Gage Co.



Microheight gage is used for either scribing or measuring with a dial indicator. Hundredths of an inch are read on the barrel and thousandths on round head at the top. The instrument, manufactured by Greist Mfg. Co., comes in two and four-inch sizes.

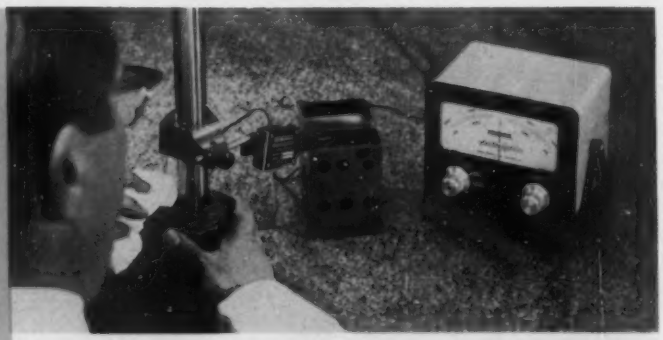


Pivotal reference type single plane balancing machine gives resultant unbalance of any force and couple present in reference to a pivotal point. The resulting unbalance is indicated for a single plane type correction. Overhung arbor suspension simulates actual conditions under which the part is used. R. B. Annis Co.



Depth-Mikemaster is manufactured by Size Control Co., Div. American Gage & Machine Co., for checking depth micrometers. The tool has an accuracy of 0.0001 inch on each step. Range is 0.500 to 5.500 inch in six steps. By adding gage blocks to steps leadscrew accuracy of micrometer can be determined.

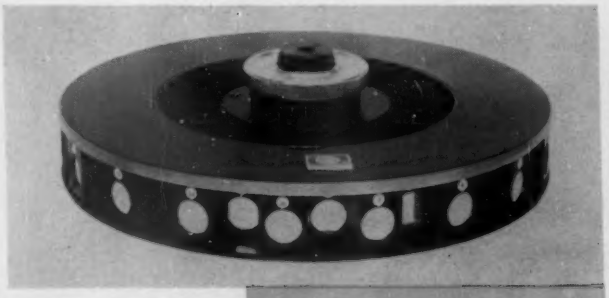
Portable electronic gage manufactured by Federal Products Corp. has portable electronic amplifier. Amplifier components are attached to the back of the meter making panel mounting possible. When mounted in regular carrying case, accessory components are stored in the rear of the case. Mercury cell batteries furnish power.



Olsen-Rava dynamic balancing machine combines pickup output voltages in a circuit which calculates the unbalance elements and visualizes them on a screen. Angular location of unbalance component is read where a radius passing through a spot cuts the periphery of the screen. The amount of unbalance is read as the distance of the spot from the center of the screen. Tinius-Olsen Testing Machine Co.

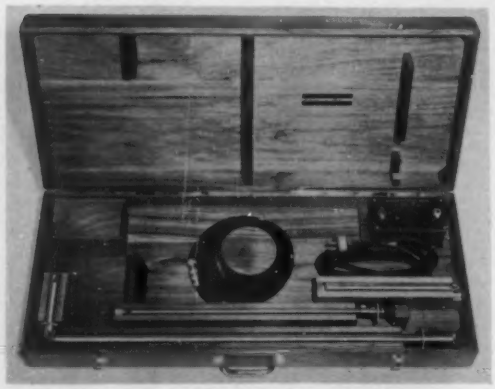
Multimi interference microscope is used for checking and measuring surface topography, surface finish and film thicknesses. Accuracy attainable is of the order of 0.02 microinch. In addition to multiple-beam interference, the instrument can also be used for two-beam interferences. C. E. Johansson Gage Co.

Optical comparator built by Jones & Lamson Machine Co. weighs 250 lb. It accommodates 8 by 10 overlay charts with eccentric chart holders in either the vertical or horizontal position. Five-power lens system provides for objects two inches in length. Standard table provides measuring area of six-square-inches.

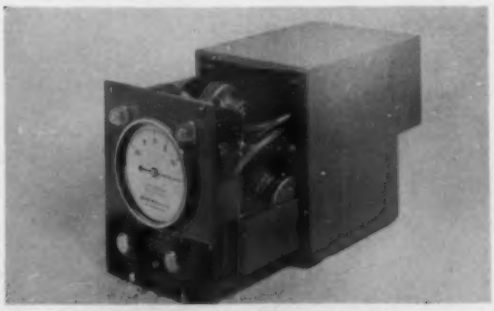


Webber Gage Co. 36-side optical polygon is furnished with a built-in leveling device designed for use with autocollimators. Polygons are available with any number of sides from three to 72 to measure angle spacing from five to 120 deg. Reflecting elements are chromium carbide.

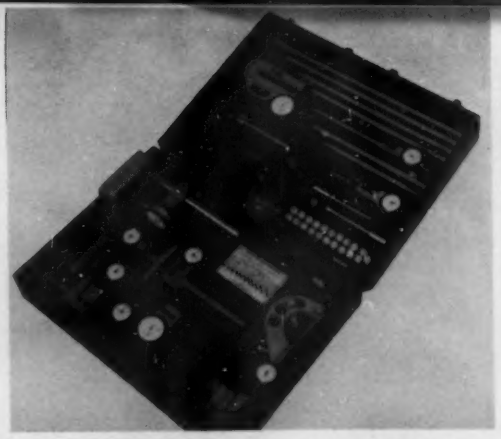
Link model 214 Fringe-count micrometer employs interferometry in combination with electronic digital counting to provide direct measurement to within millionths of an inch. In operation, measuring head is driven to zero reference position and the counter zeroed. Split beams of light source are balanced, or zeroed. Any further movement of the measuring head results in interference fringes which through integrated electronic circuits results in a direct automatic readout on the counter. Link Div., General Precision, Inc.



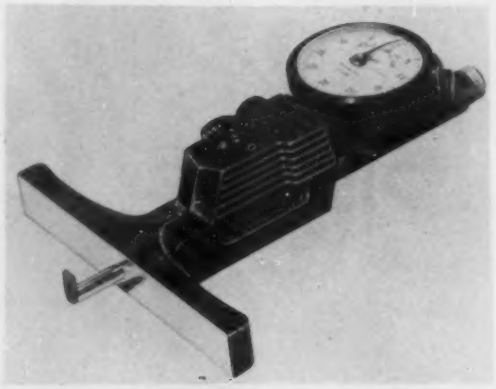
Kit, built by American Cystoscope Makers, Inc., consists of two Borescopes with interchangeable sections and illuminating equipment. Borescopes are used for internal engine inspections of turbine blades, vanes and transition sections of jet aircraft engines.



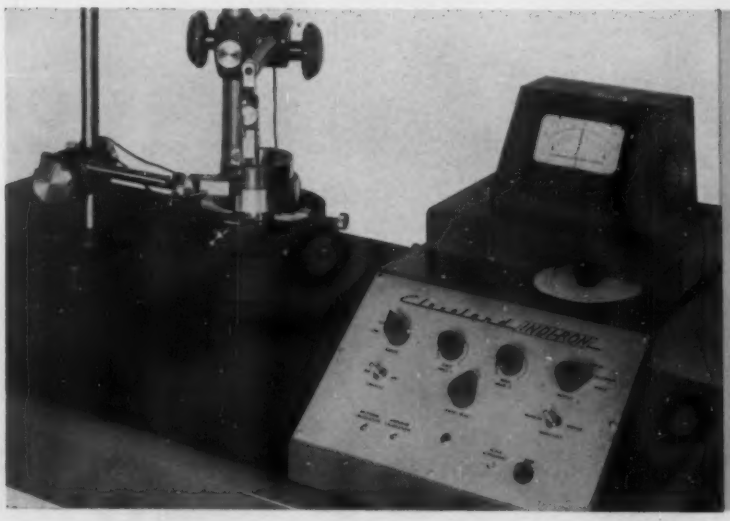
Moore Products Co. automation controller converts a pneumatic size signal to either a one or two-point electrical output. Span adjustment is built in. Zero setting is accomplished with a master.



Econ-O-Chek gages manufactured by Reliant Gage & Supply Co. are available in a fitted case for carrying and storage. Included in the kit are recess gage, bore gage, shallow hole gage, dial-pin gage, depth gage, snap gage, bench comparator, flush-pin gage, sheet-thickness gage, caliper gage and four tooling balls.

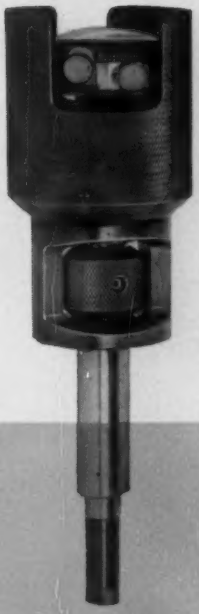


Dial indicator gage by Reli-A-Chek Corp. checks groove location, groove length and depth of holes. Groove location may be checked from either side of the groove to the face of the part by reversing gage direction of the footed rod. Width of groove is read directly off indicator dial after correct setting of gage.



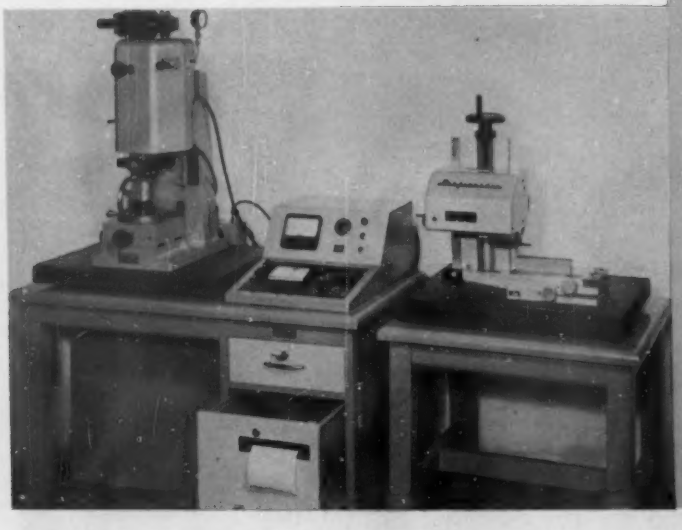
Cleveland Instrument Co. gage measures roundness characteristics. Measurements may be made for roundness, concentricity, parallelism, alignment, squareness or flatness. The gage has radial measurement from an ultraprecision spindle axis, adjustable part axis, spindle axis relationship. Part is rotated on the spindle while the gage head remains stationary. Part axis and spindle axis are aligned and mechanically locked together. Roundness and concentricity may be read directly from the meter.

Magnaflux testing unit is designed for production testing of small ferrous parts up to 24 inches in length. The unit is built to utilize waterbase wet magnetic particle method. Design permits tooling for automatic operation.

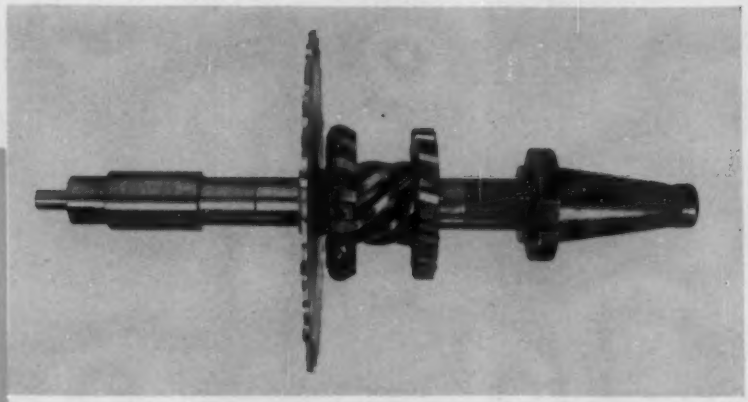


Concentricity gage manufactured by Mayes Tool Co. has indicator axially centered and recessed in head of gage so that indicator is read directly in line with hole being checked.

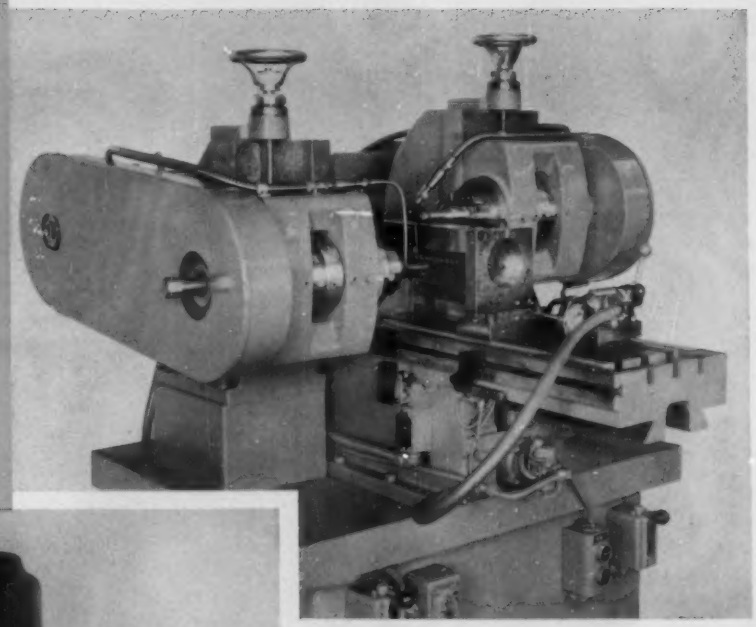
Fonda Gage Co. Inc. 23 piece ultrathin gage block set is made of tungsten carbide. The set provides sizes from 0.010 as a supplement to the standard larger sets. There are nine blocks in 0.0001 increments from 0.0101 through 0.0109; nine blocks in 0.001 increments through 0.019; four blocks in 0.010 increments through 0.040 and one 0.01005 block.



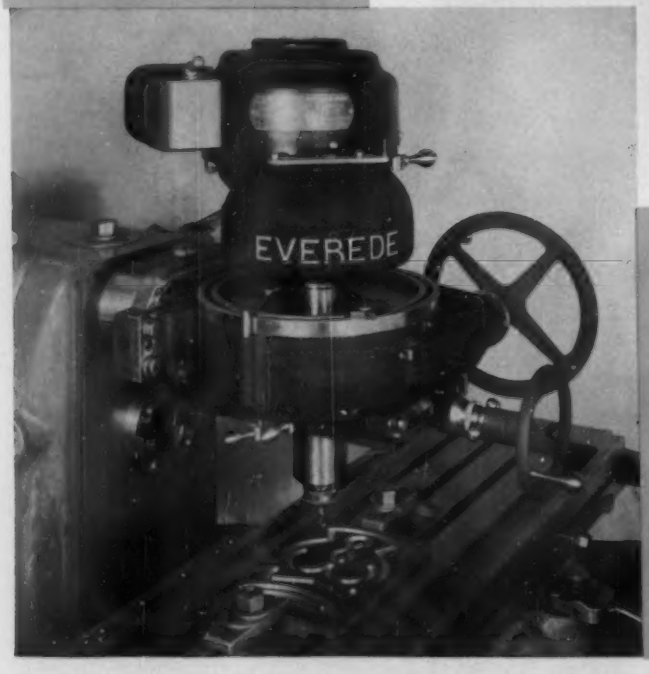
Proficorders, mechanical-electronic instruments, record on a chart the shape, height and spacing of surface irregularities. Combination shown includes both linear and rotary Proficorder along with a console Amplicorder. Each unit consists of a tracer and piloter. Tracers are differential transformer type transducers. Micrometrical Mfg. Co.



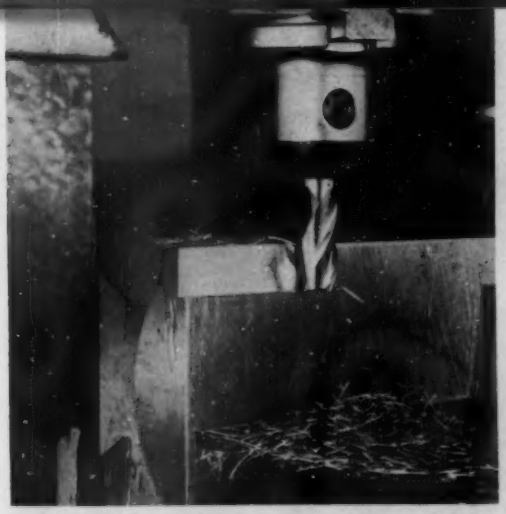
O. K. Tool Co. builds multiple-operation tooling for milling in both inserted blade and solid high-speed steel types. Setup time is reduced, while full machine power can be used.



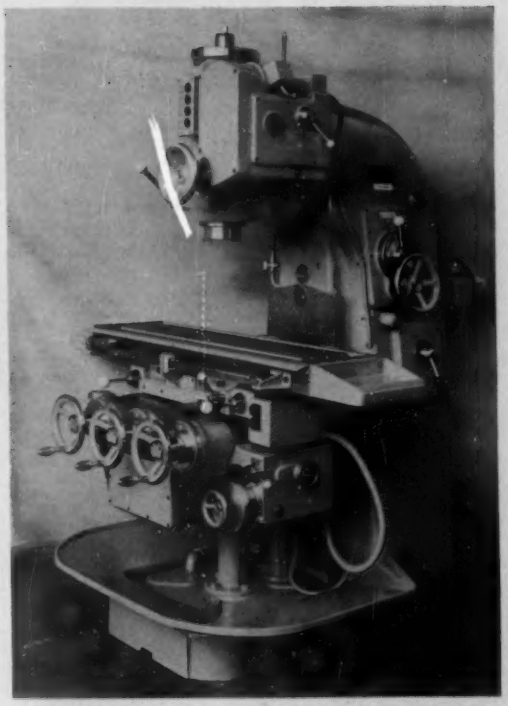
Duplex half mill has two No. 40 taper heavy-duty spindle heads, a 10 by 48-inch table mounted on a box type slide, 18-inch stroke, air-hydraulic longitudinal table feed and independent vertical spindle adjustment. The U. S. Burke Machine Tool Div., Burke Machine Tool Co.



Engineered for use with horizontal or vertical milling machines, this rotary head attachment has direct drive with a choice of six speeds. The milling attachment, built by Everede Tool Co., has adjustable limit stops, rotary degree scale, cross-slide scale and cross-slide dial. Cross-slide adjustment offsets spindle up to 3⅝ inches.

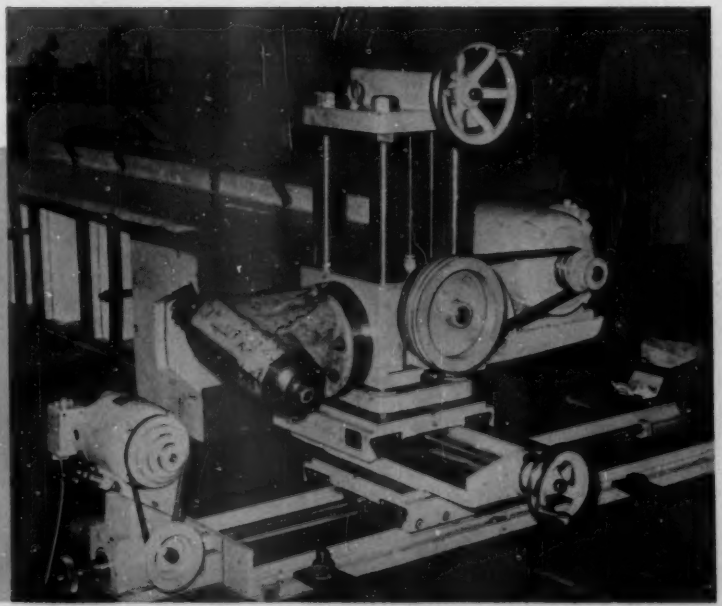


Brown & Sharpe Thriftmills are used on profiling, slotting, peripheral milling and other end milling applications. Six sizes from ⅛ to ½-inch diameter are available in both two-flute, and four-flute single and double-end types. Tools are high-speed steel.



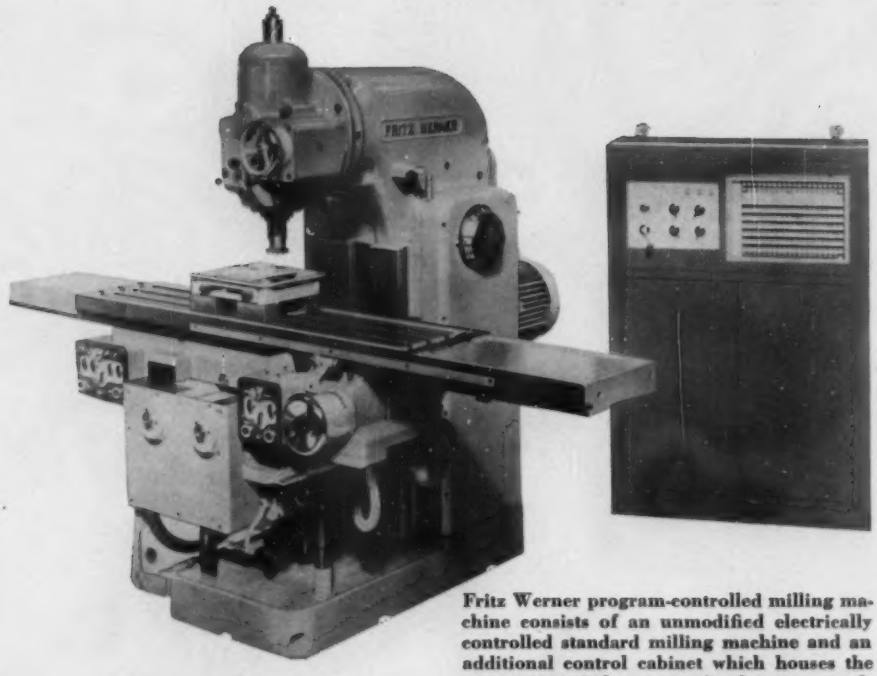
Vertical milling machines made by Reinhard Bohle Machine Tools, Inc. have automatic feed to the milling spindle. Six automatic speeds 0.002 to 0.02 ipr for down movement can be selected by two levers on the right side of the milling head. The spindle is automatically adjustable up to 5 inches.

McCrosky Tool Corp. positive angle milling cutters use square or triangular throw-away carbide inserts. The triangular insert is nested in a 60-deg pocket for wider distribution of cutting pressures.

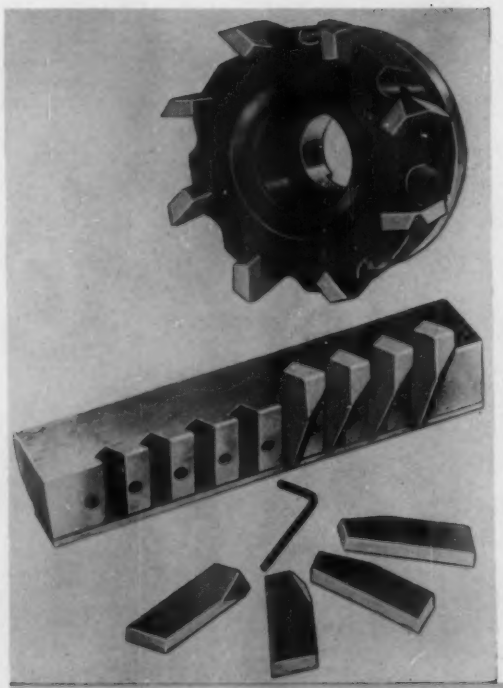


A portable milling machine manufactured by Master Mfg. Co. Inc. is made up of standard machine components. Shown performing a dovetail milling operation on a large workpiece, the unit can perform milling, drilling or boring operations on large work.

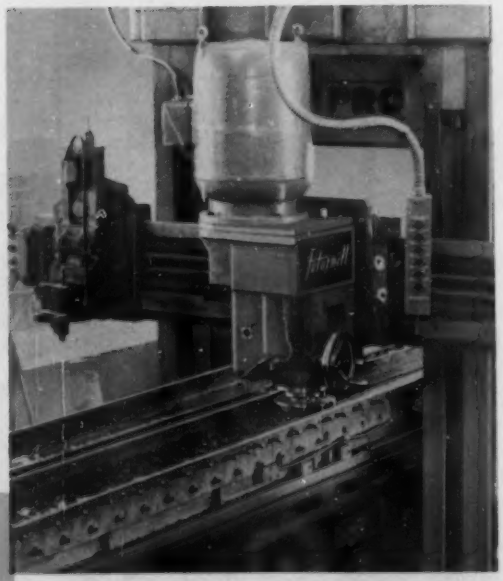
milling



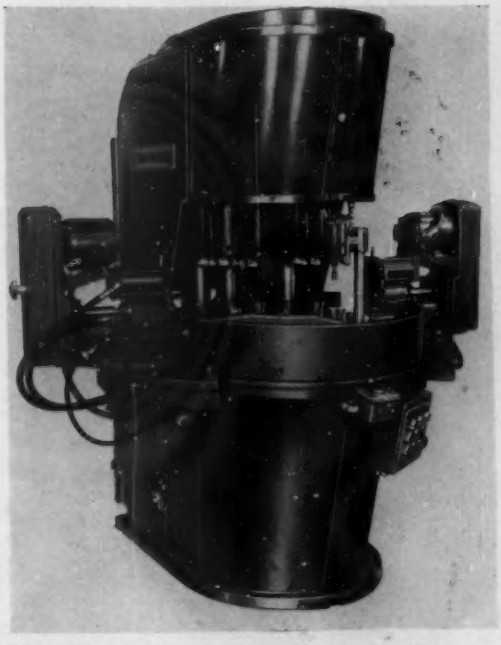
Fritz Werner program-controlled milling machine consists of an unmodified electrically controlled standard milling machine and an additional control cabinet which houses the necessary switch gear and selector controls for three-dimensional work cycles. Setting control is accomplished by selection of modes and directions of motion on the push-button panel of the control cabinet and setting trip dogs for lengths of traverse in the three milling direction. Marac Machinery Corp.



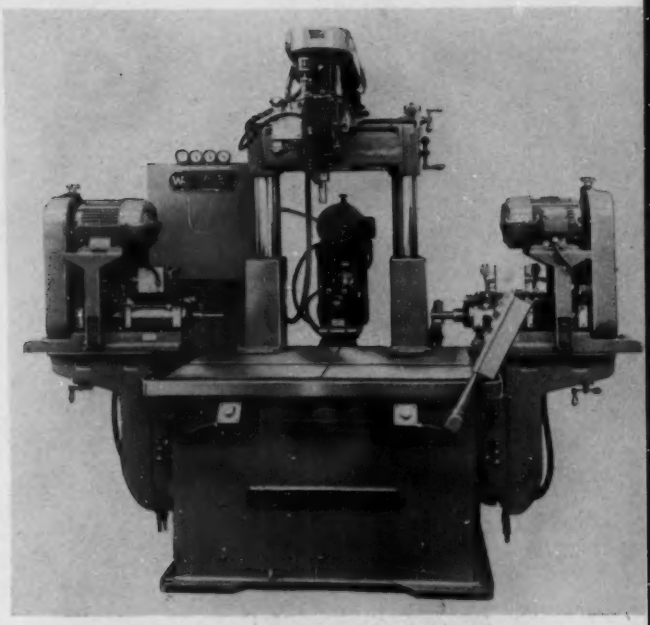
Mill-Eze cutters and sharpening fixtures are available in 3½ to 8½-inch diameters and take from six to 14 blades. Sharpening fixtures position blades for sharpening on a surface grinder. Preferred Industries, Inc.



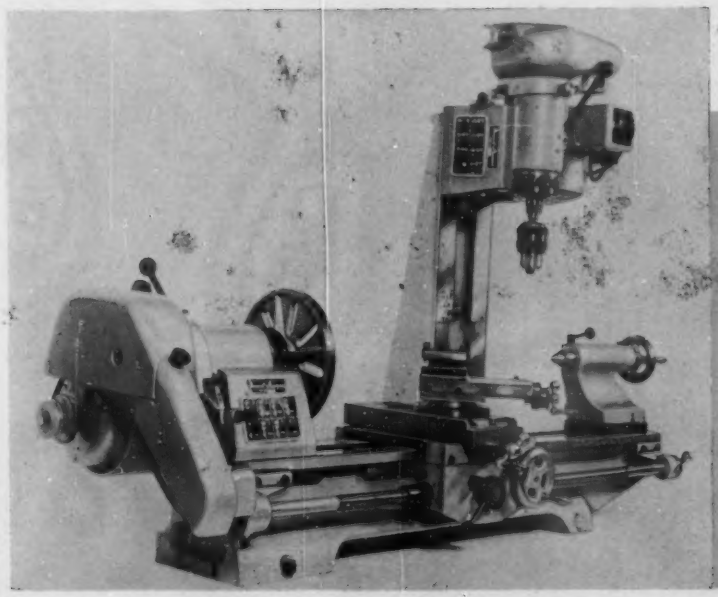
Milling spindle manufactured by Futurmill, Inc. can be used to convert planer mill. Conversion package includes drive modification and control panels in addition to the milling spindle. Speeds are 115 to 1800 rpm, using pick-off gears.



Multiple automatic second operation machine embodies a horizontal five-station index table, three vertically mounted spindles performing different operations, and two swivel-mounted horizontal spindles to perform additional operations. Machine can be used to accomplish operations like those performed on screw machines, drill presses, light milling, threading and tapping machines. Standard Tool & Mfg.

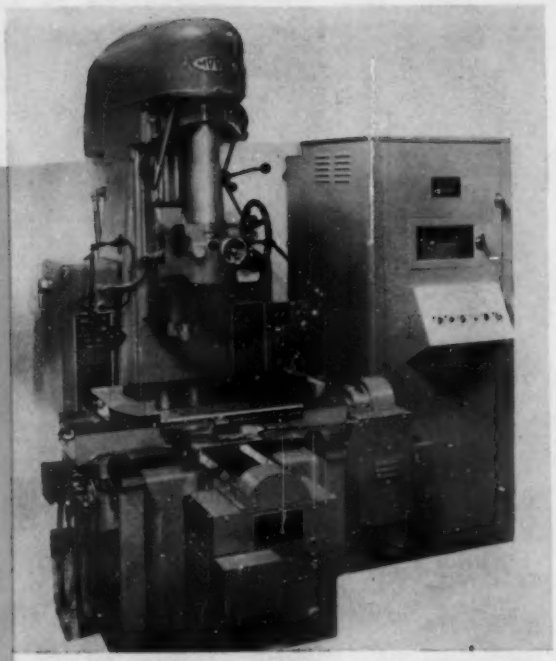


Universal machine produced by Wisconsin Drill Head Co. is constructed on the building block principle. The machine can be used for drilling, tapping, reaming and boring, or combinations of these operations. Any combination of four horizontal drill units and one vertical drill unit can be used with additional units added on existing machine. Each drill unit is adjustable vertically, horizontally and laterally.

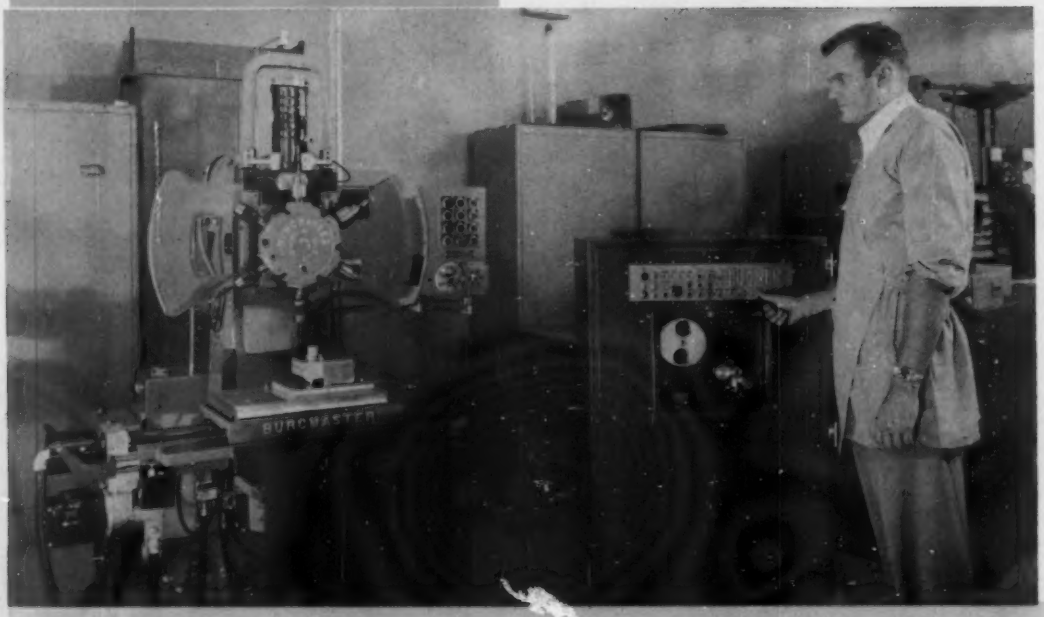


Maximat, a machine produced by American Edelstaal, can be used for cross drilling by using the milling table and external guiding head. Other applications are a vertical drill press, vertical milling machine or jig borer.

numerical control



Probomat system, developed by The Warner & Swasey Co. Control Instrument Div., is a point-to-point system for machine tools and measuring machines. It has been applied to jig borers, boring mills, milling machines, lathes, grinders, turret drills, measuring machines, positioning tables and rotary tables. The system is applicable to original equipment as well as for retrofit, both for use with leadscrews and in the form of a pilot Probomat by an absolute scale independent of leadscrew. When attached to a Moore jig borer the tape controls both slide movements to seven digits with five decimals. Probomat uses standard eight-hole one-inch tape, standard address system and Flexowriter code.



Hughes two-axis numerical-control system operates a turret drilling machine. System for two or three-axis control operates from a punched tape. Tape reader is controlled from the sequence control. Information from the tape is routed to the correct axis control and to the auxiliary functions. When a block of tape has been read into the controls, the feed axis is in the retracted position. The sequence control actuates the axis controls and auxiliary functions. The operation of the auxiliary function controls is determined by customer machine requirements. Resolution is 0.001 inch. Accuracy is ± 0.0005 inch noncumulative. Repeatable accuracy is ± 0.0002 inch. Twenty-four bits of auxiliary functions information are available. These are programmable as six binary coded decimal digits.

Hillyer numerically controlled drilling machine combines numerically controlled positioning through a 36 by 24-inch range and automatic drilling cycle. The numerical information is set into the machine by either dial or punched tape. The spindle is positioned automatically to the designated location. Spindle speed and feed are controlled through a series of eight steps which are selected by means of a dial on a control panel for corresponding holes punched in the control tape. Spindle depth settings are controlled by a series of adjustable stop dogs which are selected by the tape, punch or dial settings. Automatic tapping action can be furnished which enables tapping to be performed with an axially floating tension type tap holder. Tapping action is initiated either by punching of the tapping command hole in the tape or by a control switch on the console panel.

Drillmation electrotape machine pictured here is designed to be capable of performing such operations as boring, drilling, countersinking, reaming, tapping, trepanning, gun-drilling, and gun-boring. This machine can gun-drill finished holes with diameter to length ratios of 288 : 1 from the solid in one pass. Larger ratios can be gun-drilled using modified machines that have up to 60-inch stroke. Self-contained high-pressure, high-velocity coolant and filtration system is housed within the base.

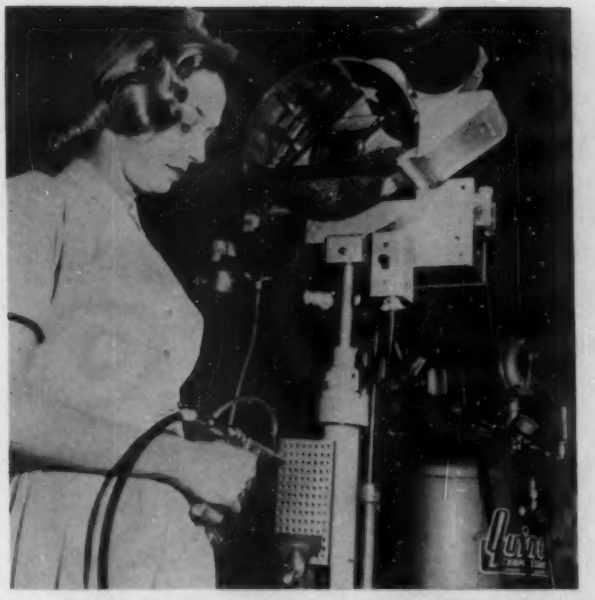
portable tools

Air screwdriver is available in both reversing and nonreversing models. The air driven screwdriver utilizes standard ¼-inch shank bits and nut runners. Exhaust is diverted into the desired direction by means of an adjustable silencing sleeve. Manufactured by Desoutter Brothers, Ltd., the tools are distributed by Newage Industries, Inc.

Enlarged base and three cutting accessories make router useful for straight and contour cutting of metals, plastics, wood or honeycomb. Accessories include router guide with vernier section for adjustment, trammel point used with router guide to cut circles, and cam sub-base. Buckeye Tools Corp.

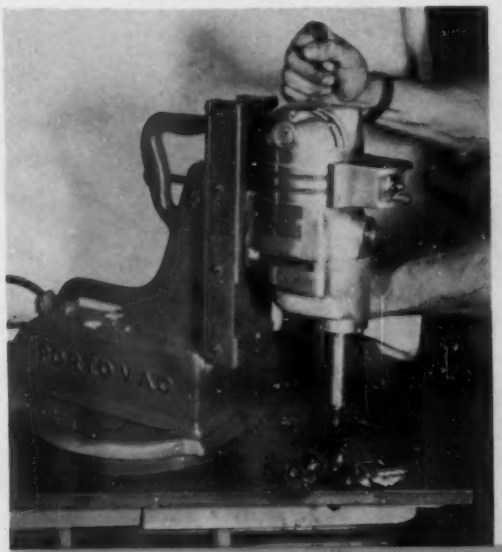
Power scraper comes in electric and air-operated models. It can be used for all scraping processes on sliding and locating surfaces. Blade has adjustable stroke to allow use on both roughing and finishing. Borel & Dunner, Inc.

Pneumatic die grinders produced by Thomas C. Wilson, Inc., have vane type motor. Tool is built with a sliding valve, remote exhaust to reduce noise level. Models are available in either 40,000 or 60,000 rpm.



Miniature inserting tool is built by Heli-Coil Corp. for installing wire thread inserts. Hopper feed and gun combination is designed specifically for automated assembly-line operation. A foot actuated switch ejects an insert from the hopper mechanism through a nylon tube to the inserting tool tip. To drive the insert, the operator presses the tool forward against the tapped hole. When insert is fully installed to a preset depth, the driving mandrel automatically stops.

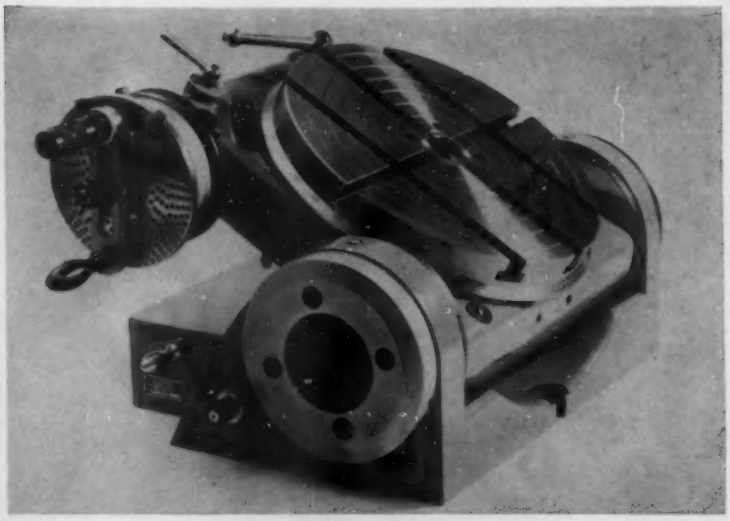
Ashcombe Co. high-speed air grinder operates at a spindle speed in excess of 300,000 rpm. A wide range of materials can be machined using especially designed carbide, diamond and abrasive tools. Airotor can be used as a hand tool or used with jig borers, lathes, milling machines and pantographs.



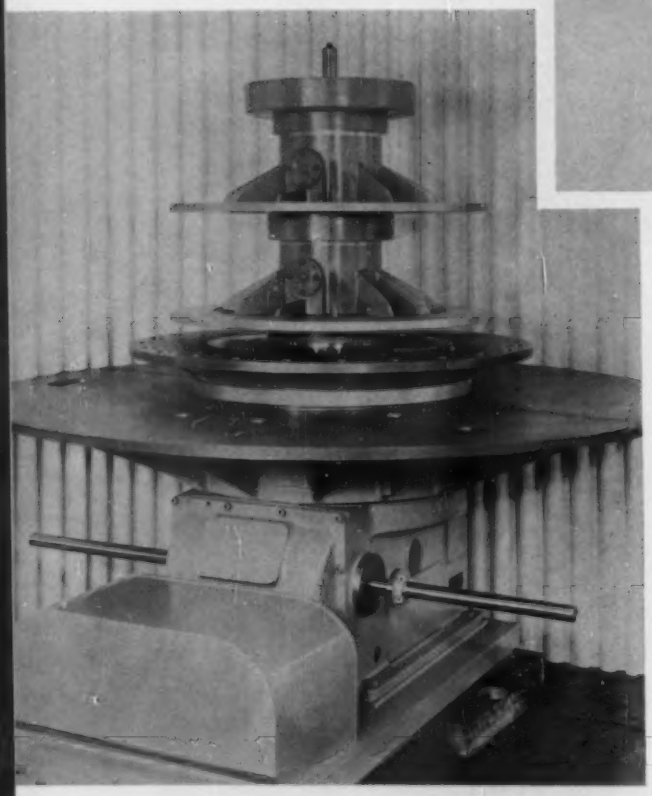
Porto-Vac is a vacuum anchored portable electric drill manufactured by Diamond Core and Saw. The vacuum base holds on any surface including thin, ferrous metal sheets, nonferrous metals, concrete and wood. The tool will accommodate drills up to one-inch diameter.

Air-powered tapper manufactured by Gardner-Denver Co. works on leadscrew principle. Tool taps up to one-inch nominal capacity. The tapper has positive feed, adjustable stroke, automatic operation and produces Class 3 threads.

positioners



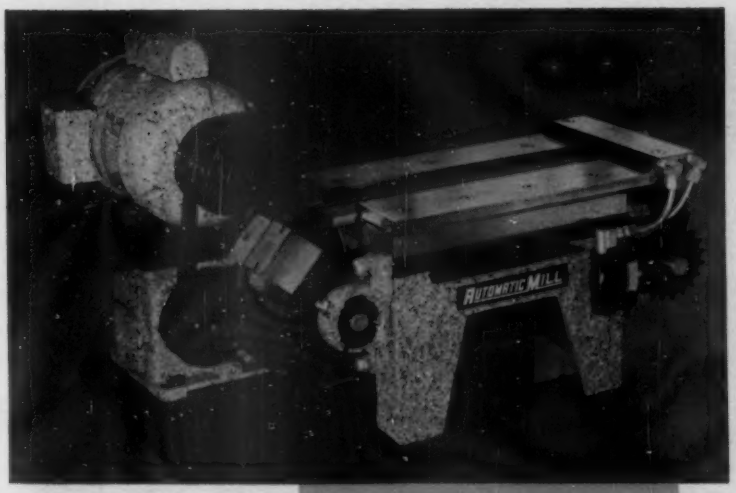
Walter tilting rotary tables are available in five sizes ranging from 10 to 25 inches in diameter. Standard series is accurate to 30 seconds. Superaccurate series is accurate to 10 seconds. Vernier readings of the two series are six seconds and two seconds, respectively. Karl A. Neise.

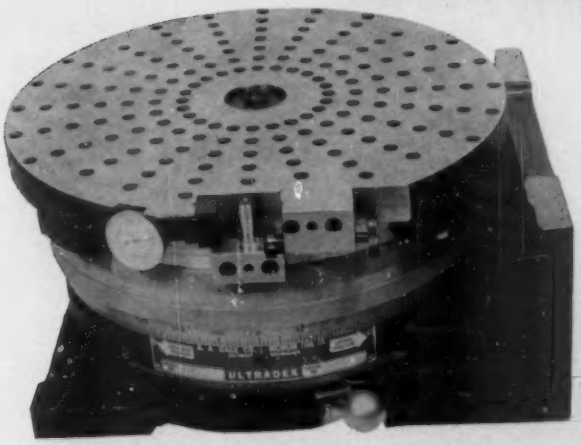


Tool plates on Swanson-Erie Corp. double-turret indexing machine are designed to move up and down with definite relative motions and are actuated by cams which are controlled by the main indexing cam shaft. Provisions are made to permit feeding, escapement and orientation of parts.

Russell T. Gilman Inc. two-position slide table can be used for turret type drilling with two work fixtures, turret type drilling with two positions on one workpiece, multiple head type drilling, or multiple spindle boring machine operations. An air or hydraulic cylinder is used to move the top slide from one position to the other. Tool mounting surface area is 30 by 12 in. Stroke is adjustable from 1 to 15 in.

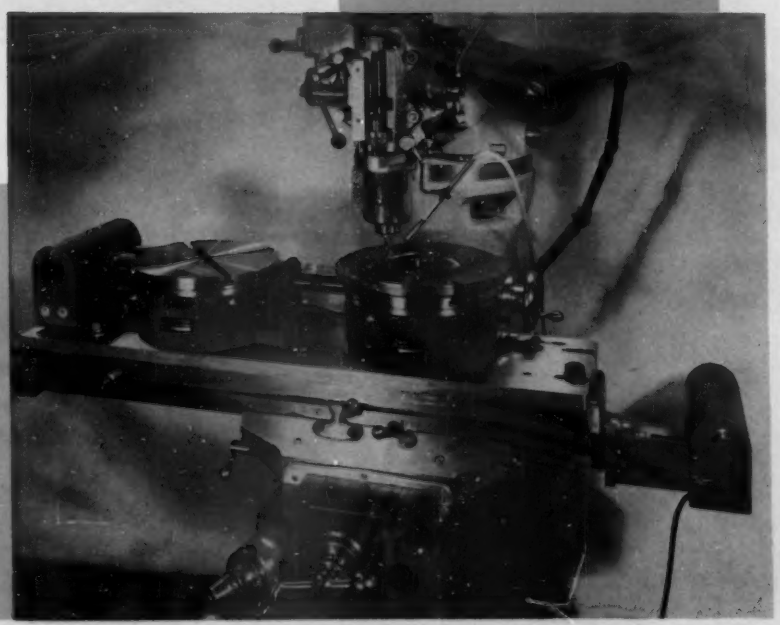
AutomaticMill employs a powerful chain drive to continuously move a matched set of holding fixtures. The unit can be attached to the bed of a milling machine. Self-contained unit has a built-in milling head. Sieburgh Industries, Inc.



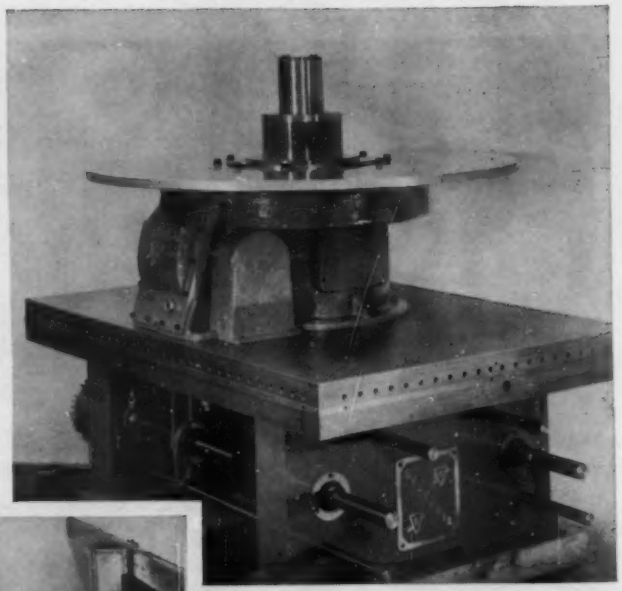


Ultradex indexing table has a pair of ground and lapped serrated master locating plates. Each plate contains 360 serrations. The two plates seat into each other for positioning and locking. The cam arrangement separates the two plates 0.1-inch for indexing. AA Gage Co.

Roto-Mill is a power rotary milling table designed for single, double or triple operation in duplicating and making cams. It can be used vertically or horizontally. Graduations are provided and limit switches can be attached to stop table. M & M Tool & Mfg. Co.

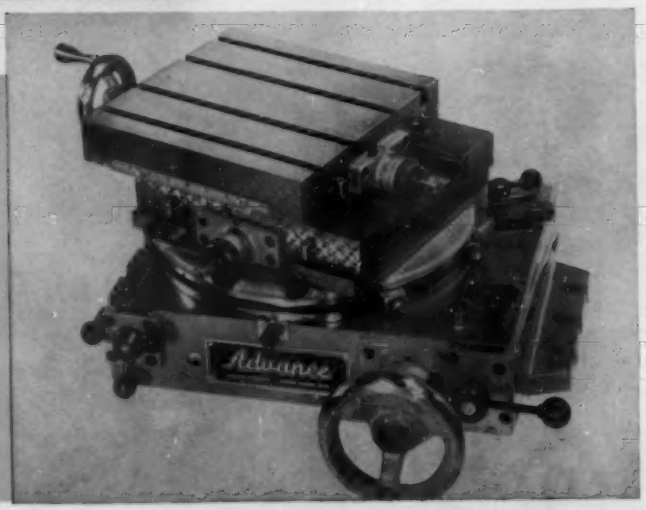


positioners

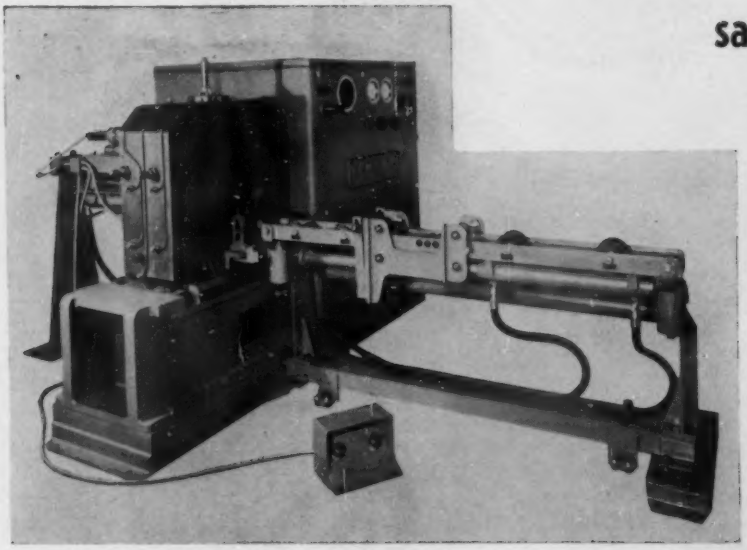


Heavy-duty rotary indexing chassis has a 40 by 60 by 5-inch base and can be used for fabricating, finishing, assembling and testing. The chassis has circumferential tool mounting, two full-length tool driving shafts and four matching rocker shafts. Sylvania Lighting Products Div., Sylvania Electric Products, Inc.

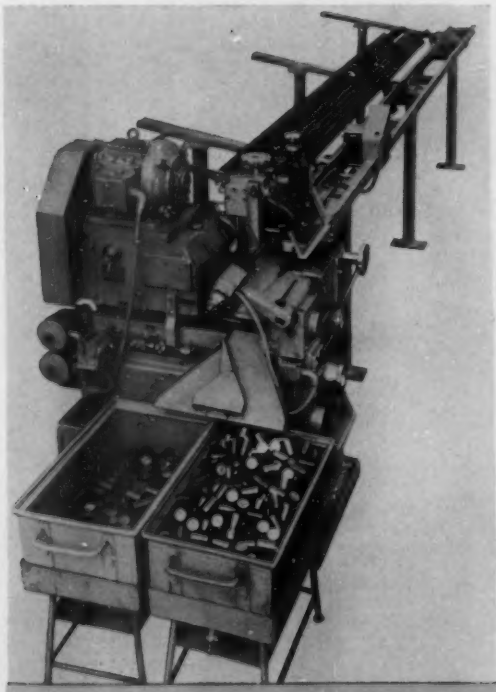
Expert automation shuttle transfer system utilizes cam index drives and a multiple drive arrangement to achieve reciprocating transfer operations. The dwell portion of the cam profile allows the motor and cam to attain speed before the transfer movement is started. Expert Automation Machine.



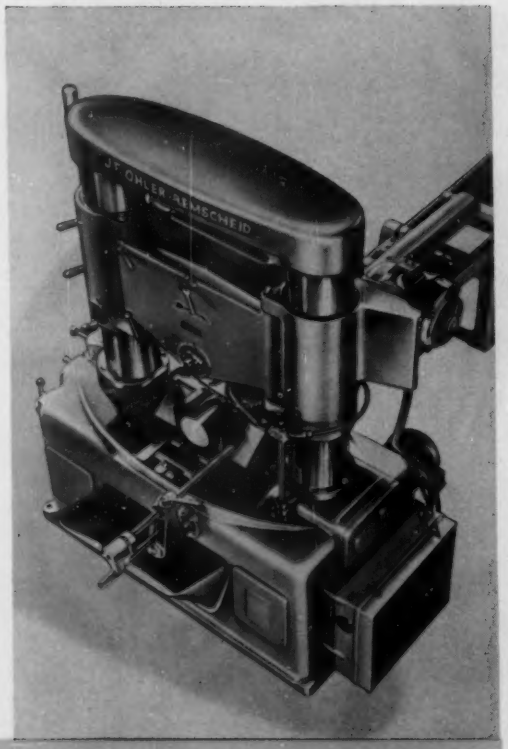
Advance Products Corp. cross-slide rotary table positions workpiece by use of cross slides. The workpiece remains in original position on the unit until all operations are completed. An indexing attachment and universal table are optional accessories designed to increase versatility.



Bar stock is torque sheared on Reactron cutoff machine. Jaws hydraulically clamp on both sides of the cutting section. One is mounted on a fixed steel disk, the other is a movable steel disk. Hydraulic pressure forces the movable disk jaw in a downward rotary motion, exerting torque and shear to cut off the metal. Manufacturers Associates.

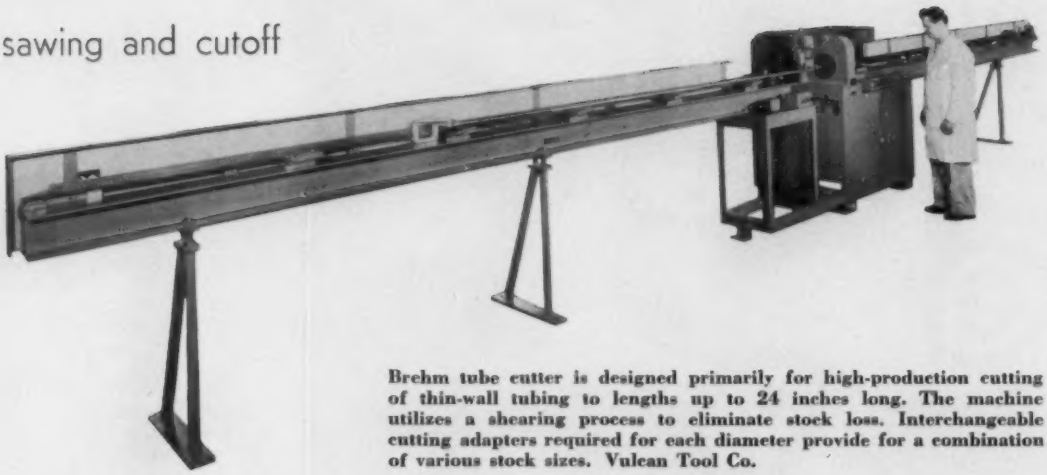


Series 200 Wagner high-speed cold saws feature a new type loading table and automatic scrap separator. A measuring roll controls both the cropping cut and ejection of the remnants. Accurate cutoff lengths are maintained by an electrically controlled length gage. Albert Klingelhofer Machine Tool Corp.



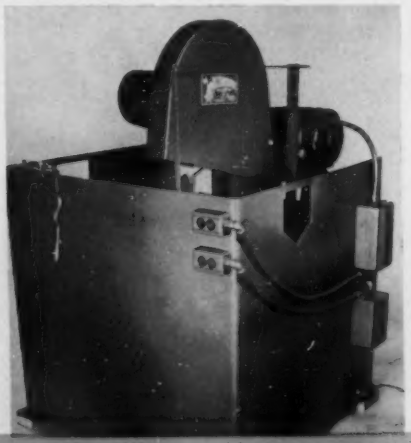
Ohler circular cold sawing machine has automatic material feed mechanism with a pair of adjustable tongs operated by a hydraulic cylinder. A duplex vise spreads the clamping pressure over the two workpiece ends. The machine can be indexed from fully to semi-automatic operation and vice versa, during operation, by means of a control lever. James W. George Machinery Co.

sawing and cutoff

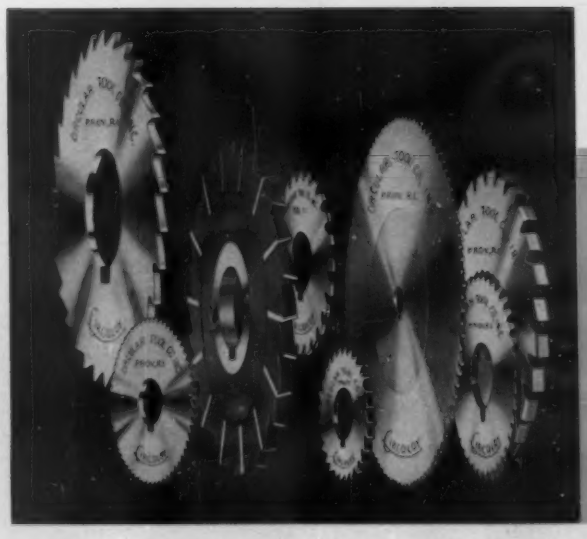


Brehm tube cutter is designed primarily for high-production cutting of thin-wall tubing to lengths up to 24 inches long. The machine utilizes a shearing process to eliminate stock loss. Interchangeable cutting adapters required for each diameter provide for a combination of various stock sizes. Vulcan Tool Co.

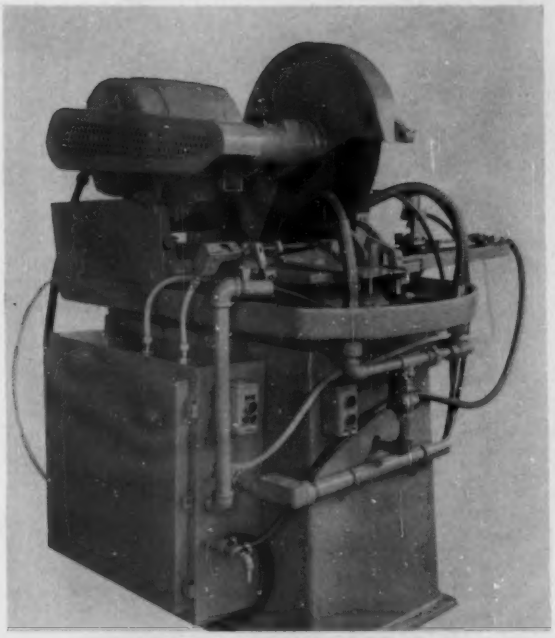
Hydraulic stock cutter has portable heavy-duty power pump mounted on a steel plate with channel type skids. Cutter head is equipped with a pistol grip. Power is applied through finger pressure on control button. Quick-detach coupler allows fast change-over to any one of three sizes of cutter heads. H. K. Porter.



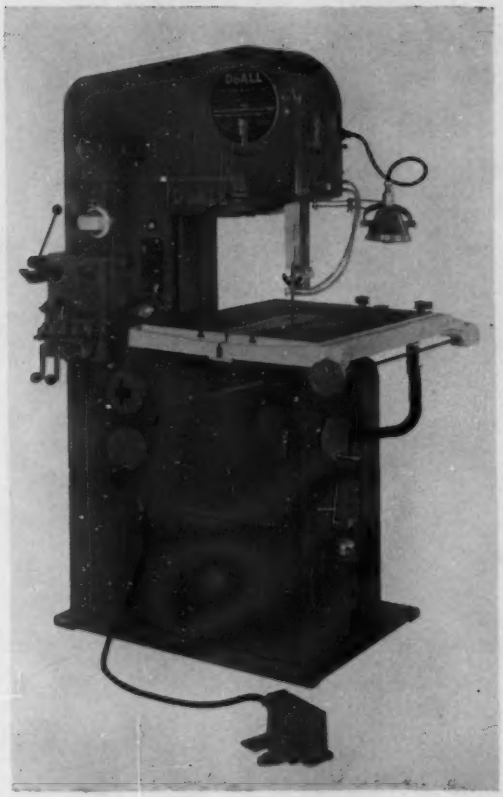
Abrasive cutoff machine manufactured by Beaver Pipe Tools, Inc., has automatic features for fast operation and to permit machines to be operated by relatively unskilled help.



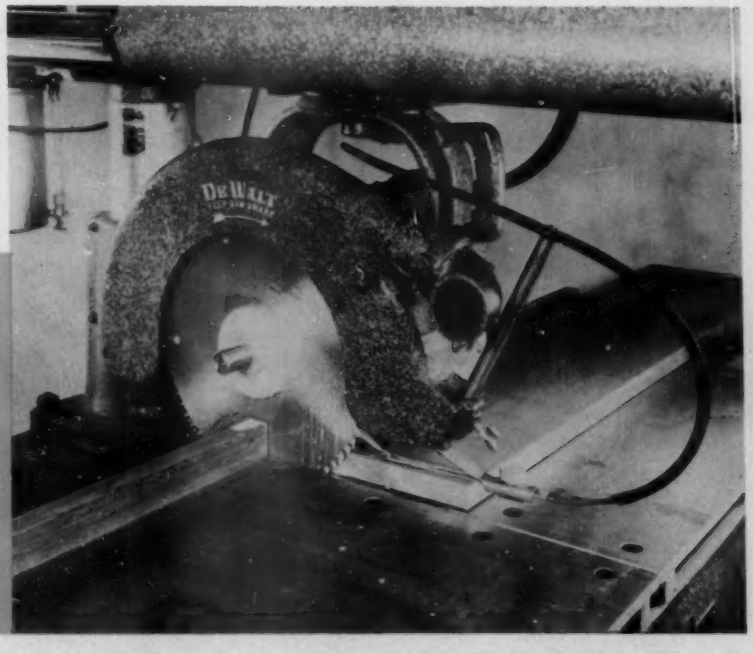
Saws in a variety of sizes and tooth shapes are offered by Circular Tool Co. Selection includes saws for metals and plastics.



Fully automatic abrasive cutting machine is designed to cut bar stock up to one inch in diameter in from ¼ to 6 inch lengths. Wheel wear compensator automatically returns wheel to uppermost position. A. P. DeSanno & Son, Inc.



Equipped with a flash welder for narrow high-speed steel saw bands, this DoAll Contour-matic band saw cuts contours, angles, slots or recesses in metals and nonmetals. Machine is particularly useful for internal sawing in tool and die work on high alloy steels.

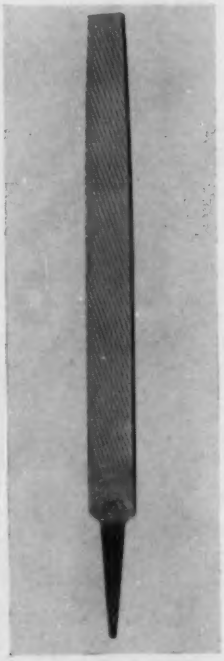


Radial-arm cutting machine is especially designed for cutting of nonferrous metals on a variety of cutting jobs. Machine has carbide-tipped saw blade, precision-controlled air-hydraulic feed mechanism and automatically integrated mist-coolant system. DeWalt Div., AMF.

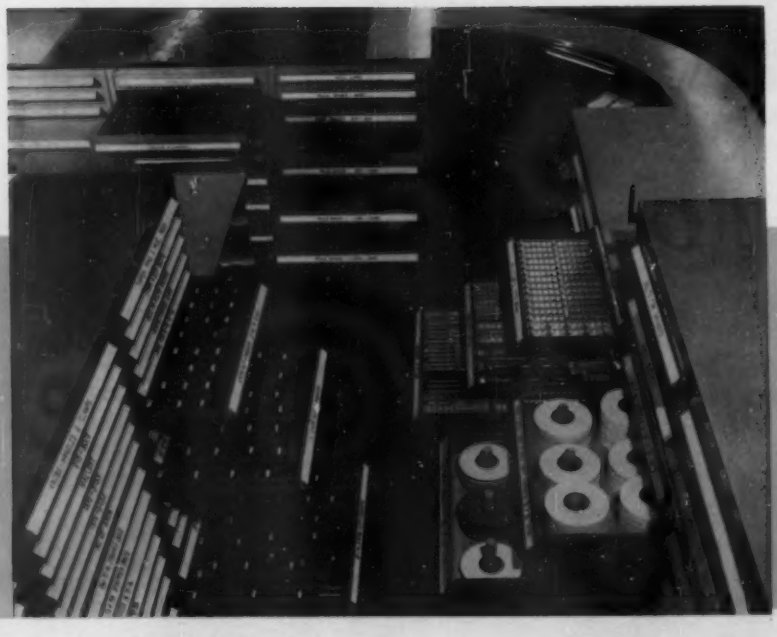
shop aids

Schwartz Boring benches have hard maple tops. Sizes are 24, 30 and 60 inches wide with lengths from four feet.

Unknown types of tool steels are classified by using this tool steel spark tester. Spark from unknown grade is compared to that of the standards. Set of standards may be composed of any commercially available steel. GLD Products Co.

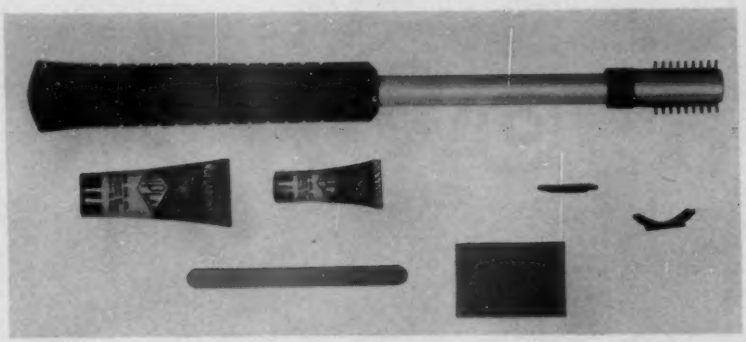


Magicut file manufactured by Nicholson File Co. has planer type teeth which can be used on different metals.

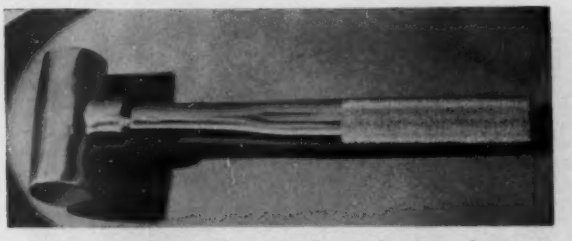


Vidmar, Inc. tool storage units have modular design to allow changes when storage requirements change.

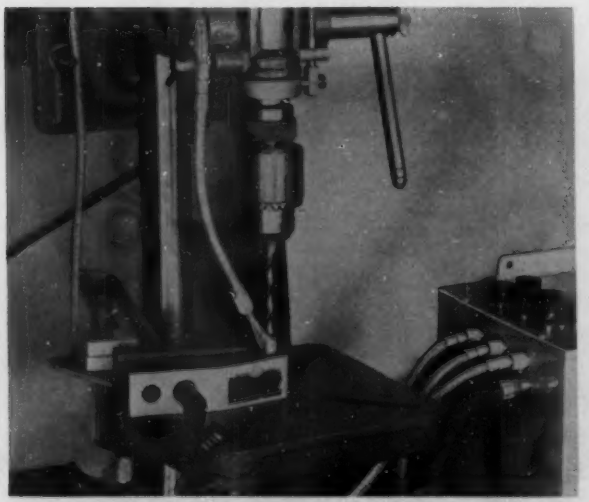
Universal hammer handle made by Nupla Mfg. Co., Div. of New Plastic Corp. utilizes epoxy plastics to lock the handle head. Self-aligning ferrule adjusts to any eye opening and positions the handle during the cure cycle. Handle contains glass fibers.



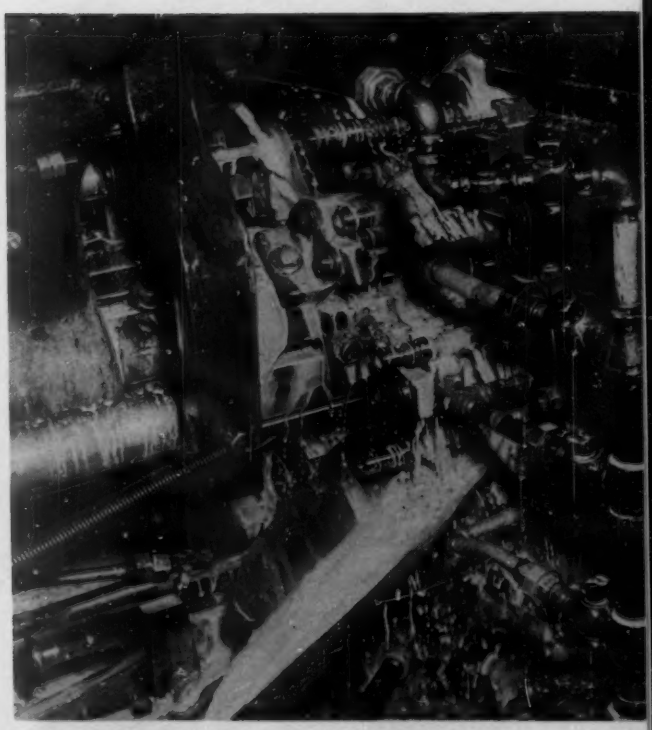
Deveon Corp. Plastic Steel comes in putty or liquid form. Liquid type can be poured to make forming and drawing dies, models, patterns, pattern duplicates, core boxes, molds, jigs, fixtures and holding devices.



Copper, brass, lead and aluminum hammers are manufactured by Univertical Corp.



Custamist lubricating system has a choice of one to 16 outlets making it suitable for a central mist lubricating system. Units incorporate a two-valve control system for air and lubricant, armored outlet line, flexible double filter nylon intake line and hooded spray tip. Custanite Corp.



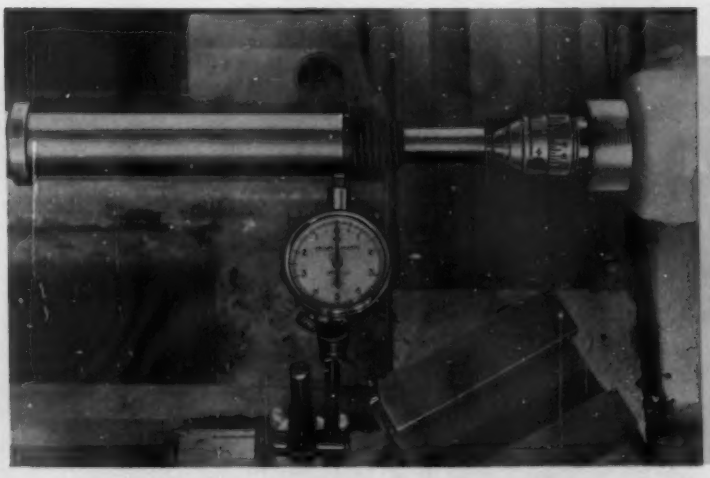
Replacing straight oil, water soluble cutting fluid manufactured by Park Chemical Co. is used on screw machines in an automotive manufacturing plant.

special cost-cutting tools

Jiffy Disintegrators Inc. machine has quill or gravity feed attached to the end of the radial arm which can be adjusted to 90 degrees for angle work. Movement of column and radial arm carriage gives full control of a work area from zero to four feet. Radial arm travel can be locked.

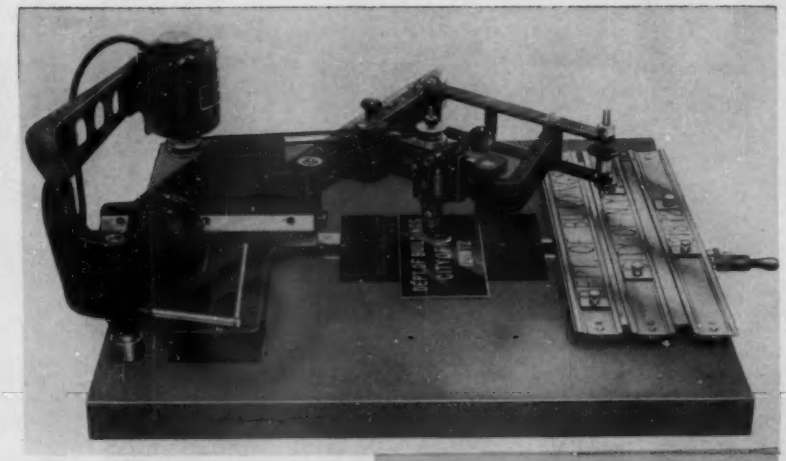
Tear-tape opener is feature of Jiffy Mfg. Co. padded shipping bag. Seam is secured by a waterproof adhesive.

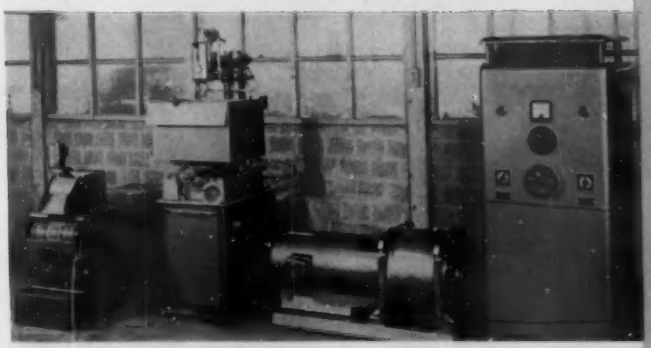
Two-speed, one-hp speed lathe for either bench or pedestal mounting can be equipped with collets, expanding mandrels, air chucks, vacuum chucks, magnetic chucks or other holding fixtures for parts of irregular contour. Schauer Manufacturing Corp.



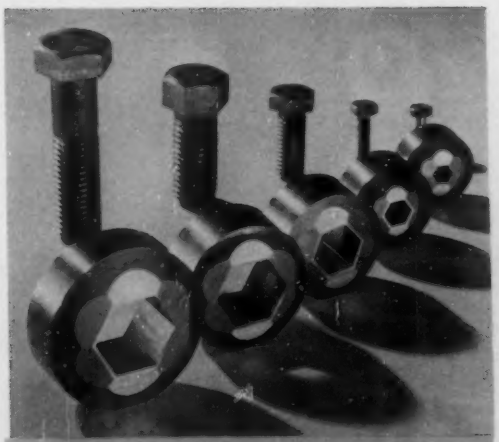
Designed for center alignment on old or new machines, an adjustable center eliminates tailstock jogging usually required when precision or taper turning. Corrective movement of the work held between the lathe headstock and the adjustable center is accomplished by an equally eccentric ground sleeve and arbor which when assembled complement each other and produce lateral movement of the tip. Enco Mfg. Co.

Machine engraves plastics, metals, wood, mother-of-pearl and other hard materials. It can also be used to decorate, shape, graduate and number. Pantograph arm traces from type or master template in this machine built by New Hermes Engraving Machine Corp.





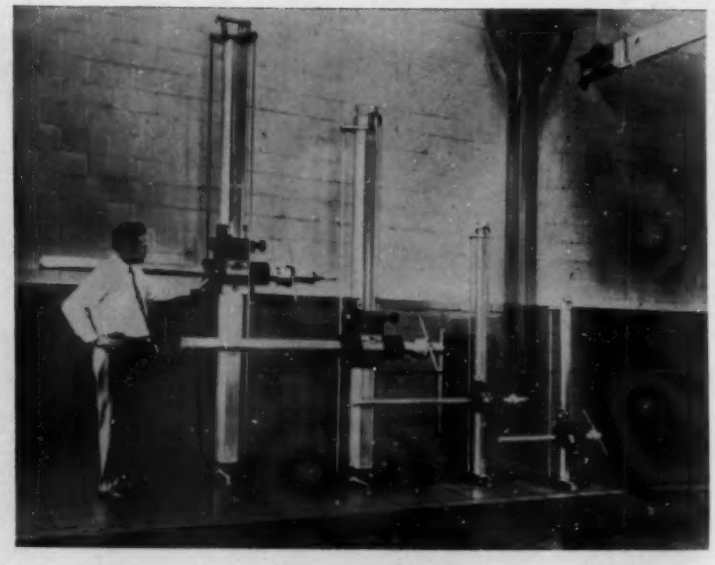
Rapid sinking of die cavities and odd-shaped holes in any metal is provided by spark-erosion machine manufactured by Easco Products, Inc. Four power settings are provided with a maximum output of 250 amp at 25 volts. Electrodes may be aluminum, copper or brass made to the shape of the hole or cavity.



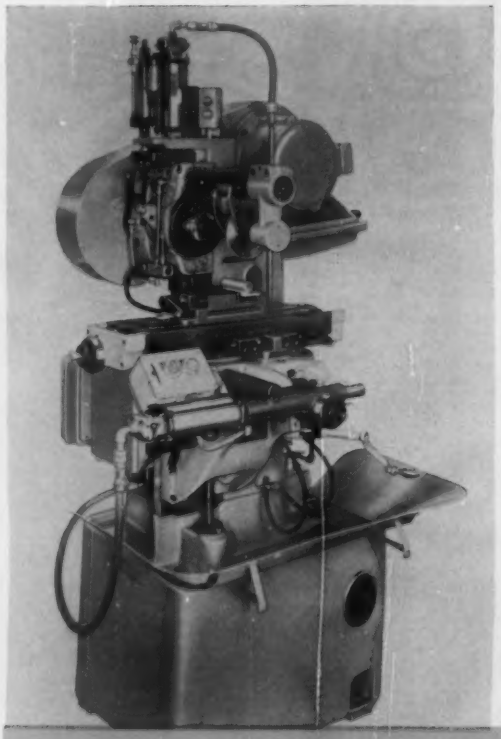
Trim dies for trimming after cold-heading operations are available in an assortment of sizes from Leland-Gifford Co.

Model HCS-59 electrolytic cavity sinker applies electrolytic principles for sinking of irregular holes and shapes following the contour of an electrode made for the purpose. Anocut Engineering Co.

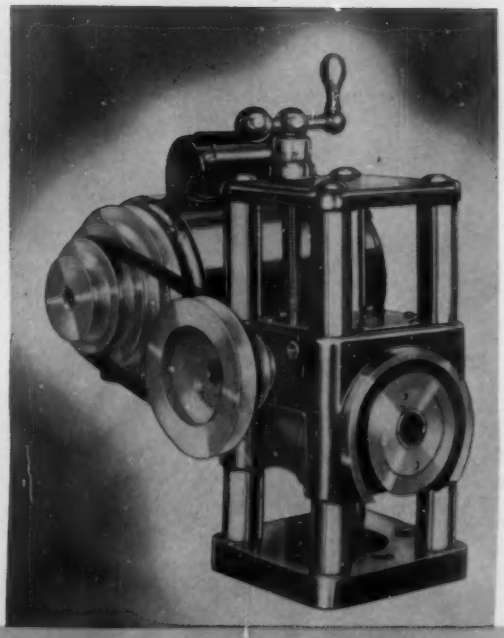
special cost-cutting tools



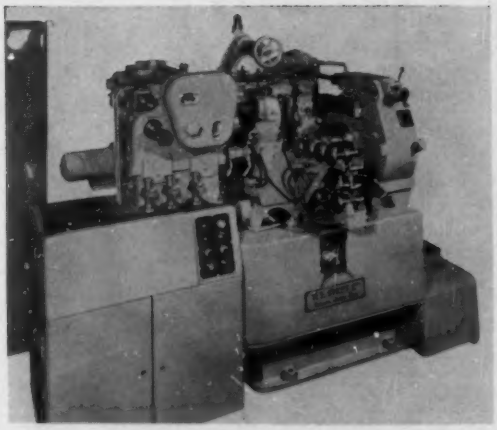
Machines for layout work on two, four, six and eight foot high castings have horizontal reach of 18, 36, 48 and 48 inches, respectively. These machines are used to layout vertical, horizontal, inside or outside lines for final machining. The upright column, cross-arm and linear attachment have vernier scales. Portage Double Quick, Inc.



Crystal grinder developed by W. H. Nichols Co. combines a variable-feed, downward-plunge cut with a synchronized automatic increment cross-feed. The machine is used for wafering germanium, silicon, quartz and similar materials. Cutter arbors are fitted with special wheel flanges that fling coolant to the periphery of the slicing blade and into the cut. Ball-bearing arbor support is also mist lubricated. REM Sales.

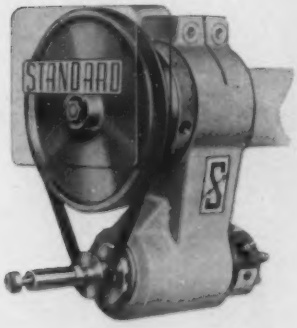


Versa-Mil portable machining unit includes milling head, motor and vertical speed mechanism. The unit can be mounted on a lathe, planer, shaper or mill to convert equipment to milling operations, or may be used for in-place machining of components too large to be conveniently placed in a milling machine. Attachments include high-speed head, grinder, and slotter. Dumore Precision Tools Co.



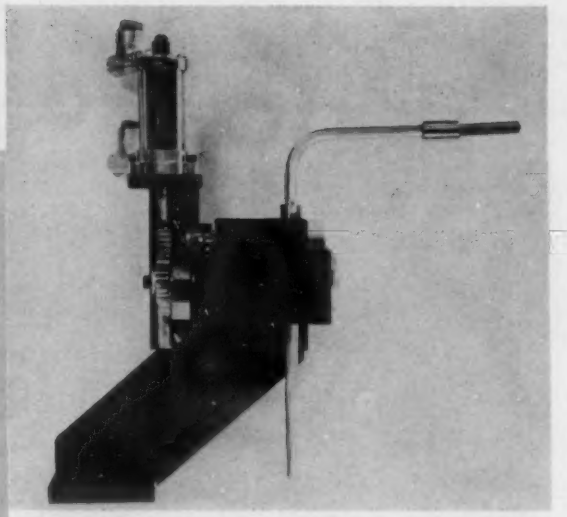
Horizontal gear generator is equipped with magazine loading and automatic cycling. Hydraulically operated saddle has infinitely variable dial control for infeed. Approach and saddle drop-off can also be individually controlled from five adjusting screws mounted on the front of the machine built by Sykes Machine & Gear Corp.

Bischoff Chemical Corp. strippable plastic coating provides protection for metal parts in cutting tools during storage and shipment. Ethyl-cellulose resin also protects nonsoldered areas from contamination during soldering operations.

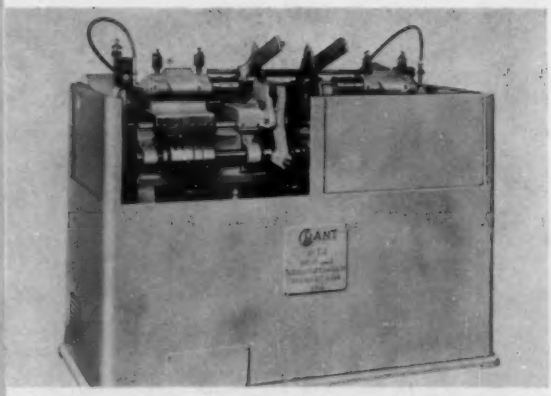


Conversion equipment for present machinery built by Standard Electrical Tool Co., includes a 50 amp high-speed electrolytic grinding attachment with interchangeable quills for assembly on the spindle nose housing of a conventional surface grinder.

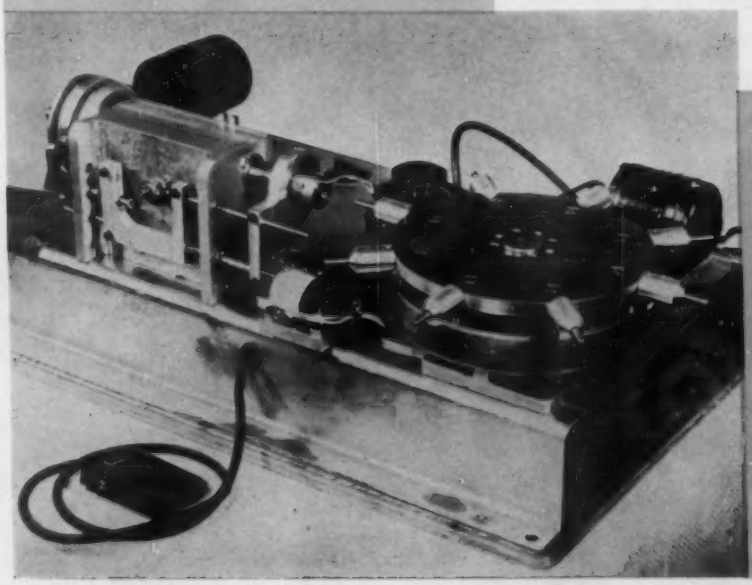
Speed of operation and versatility are offered as features of Davis keyseater machine. It can be used for installing keyways in the bores of gears, pulleys, etc. Davis Keyseater Co., Div. Hansford Mfg. Corp.



Air-operated orientation and escapement unit is customer built to handle a specific part. Production rate of orientator varies up to 150 pieces per minute. Unit corrects position of cylindrical parts as they enter from a vibratory parts feeder at random in a tube and discharges on a time sequence. Peeco Div., Automation Devices.

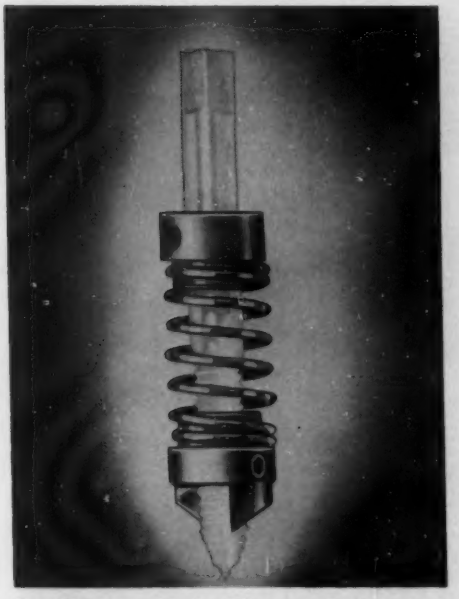


Automatic threading machine is designed to operate simultaneously on both ends of such parts as tubes, rods and spindles. Machine cycle is automatic and adaptable to a range of diameters, lengths and number of threads by changes in cams, gearing and clamp-jaw inserts, and adjustments in the magazine feed and toolhead. The Grant Mfg. & Machine Co.

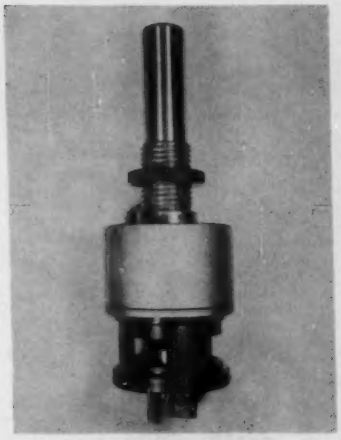


Coil Winding Equipment Co. has made available a group of automatic and semiautomatic machines for winding and finishing electrical coils. Single or multiple layer coils of a wide range of sizes can be produced on these turret type machines. Cementing, cutting, ejecting and other features are available.

spot cutting and facing



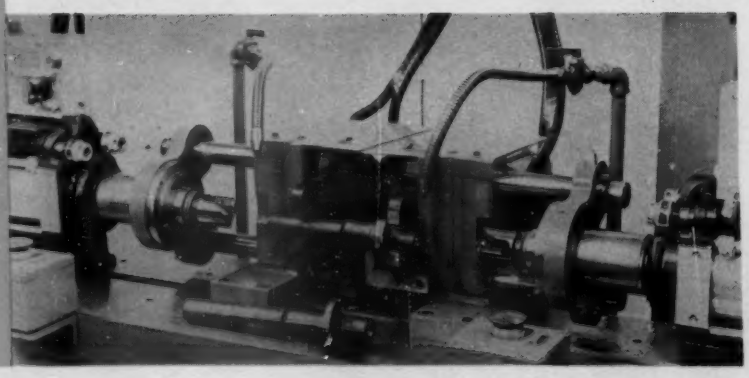
Burr-Bit tapped hole deburring device deburs hole after the tapping operation as the tap is withdrawn from the hole. Sizes are available for two and four-fluted taps from No. 2 to ¾ inch and for three-fluted taps from No. 2 to ½ inch. Vernon Devices, Inc.



Intramatic tool is designed to automatically perform cutting within or at the back side of a previously formed hole. A cutter is channeled within the pilot and is cammed out directly adjacent to the cutter tip by a cooperating edge within the pilot. Nobur Mfg. Co.

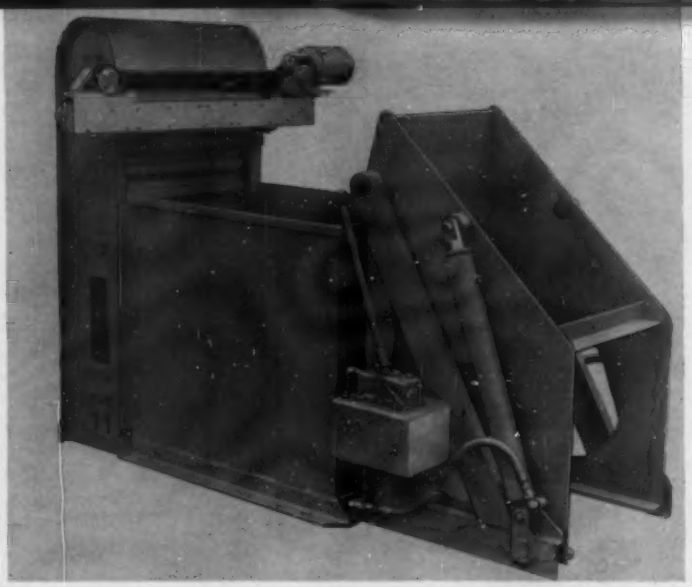
Tube finishing tool made by Cogsdill Tool Products, Inc. chamfers OD and ID and end faces tubing. The cutting blade is contained in a spring loaded carbide cone tip. Upon contacting the work cone retracts exposing the blade for cut.

Double-end machine, equipped for center face work, has equalizing fixture, combination center and face tool and support quill spindle. Spindles are simultaneously retracted after dwell. Two air-operated equalizing clamp fixtures with interchangeable jaws are on the machine. Hause Machines, Inc.



stock handling

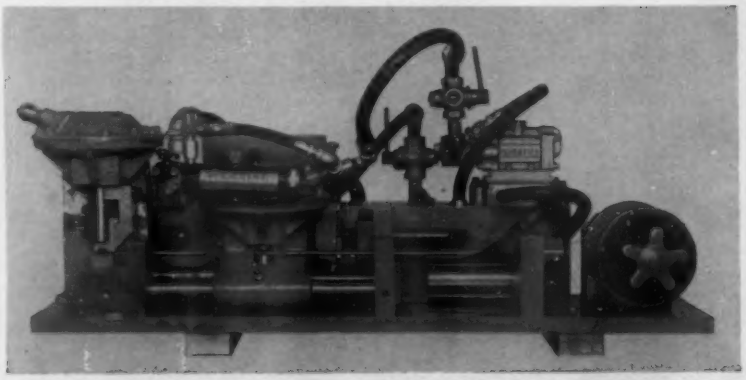
Clark Industries hopper feeder for cylindrical parts, by means of a continuous operating vane type elevator, aligns and conveys cylindrical stock from hopper and a powered outfeed mechanism. Up to 7000 average length cylindrical pieces per hour can be fed by regular models into centerless grinders, automatic lathes, dial feed presses, forming machines, assembly devices, billet heaters, etc.



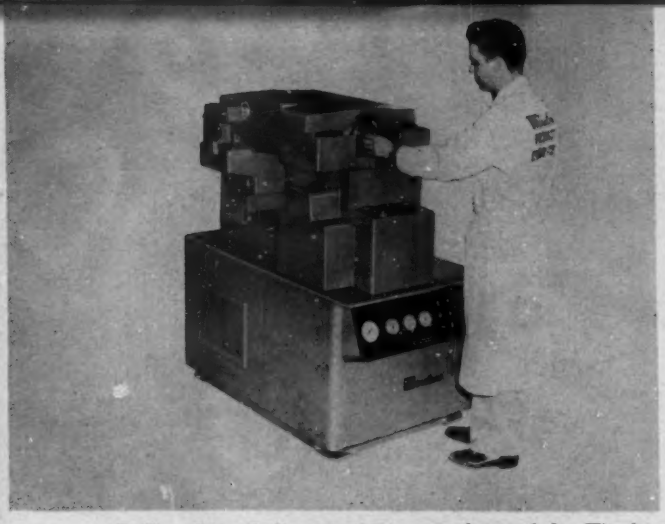
Multiple orienting requirements are performed on this lock tumbler body. Straight line orientor passes all parts through the isolating tooling for the proper end selection. Misoriented parts are recirculated. Tuned frequency vibratory motion rotates the parts for radial alignment. Campbell Machines Co.

Parts ejected from machinery strike feelers of this assembly to send an impulse to a missing parts detector control. If the impulse is not received, the machine is prevented from striking again. Wintriss, Inc.

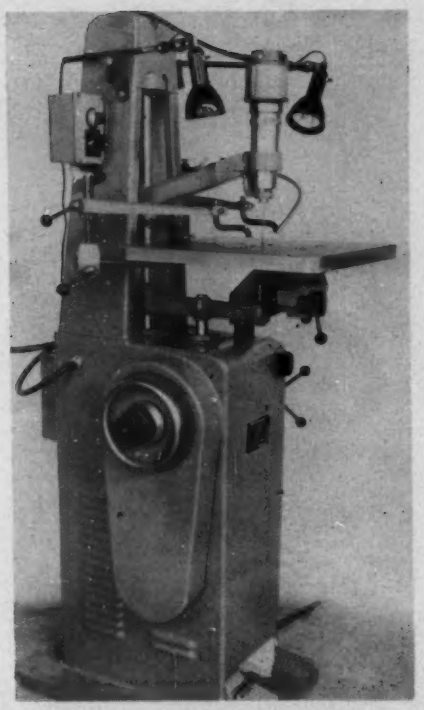
Vibratory inducer weighs only 4½ ounces. Vibration is generated by a rolling ball driven in an orbit on raceways of ground steel. Martin Engineering.



Ses-Matic feeds and cuts off wire with an accuracy of 0.002 inch. Speed of unit is adjustable with a speed control valve. For feeding and cutting fine wire, a pay-off spool is mounted directly on the feed unit base. Special Engineering Service Inc.

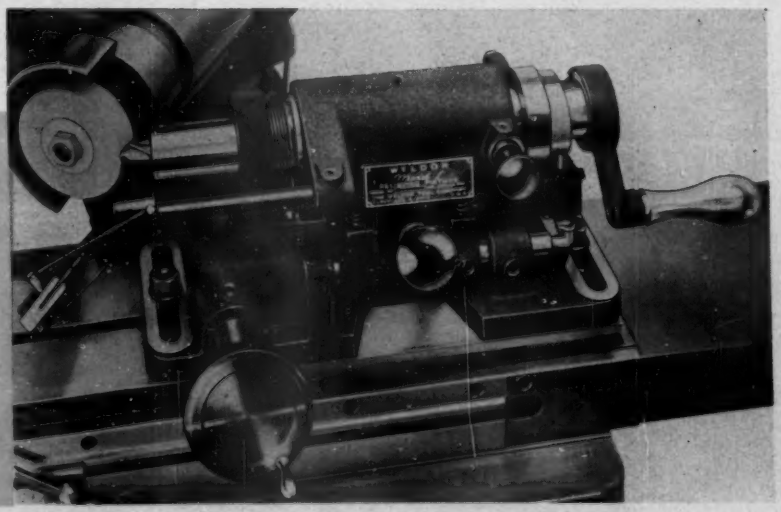


Drill point grinding machine manufactured by Winslow Product Engineering Corp. produces conventional generated drill point or helix point. Forms are generated by means of a combination of two cam movements. After grinding, drills are automatically ejected. Wheel dresser is fully automatic and hydraulically operated. Quantity of drills pointed between wheel dressings is provided by selector switch.

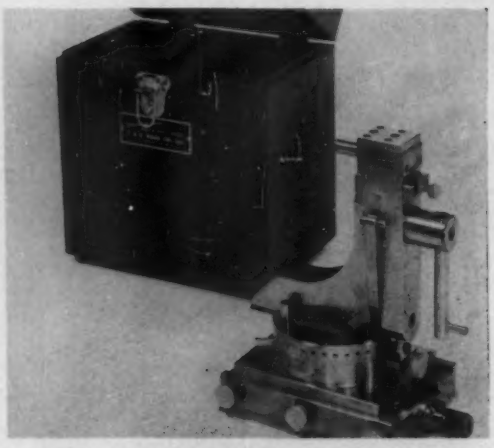


Toolmaking machine manufactured by The Producto Machine Co. can simultaneously rotate and reciprocate cutting tools. This action makes possible a stylus machining technique which uses templates to duplicate irregular and contoured die, punch or piece part shapes. The motor bracket can be interchanged with a filing bracket for conventional filing, sawing and lapping.

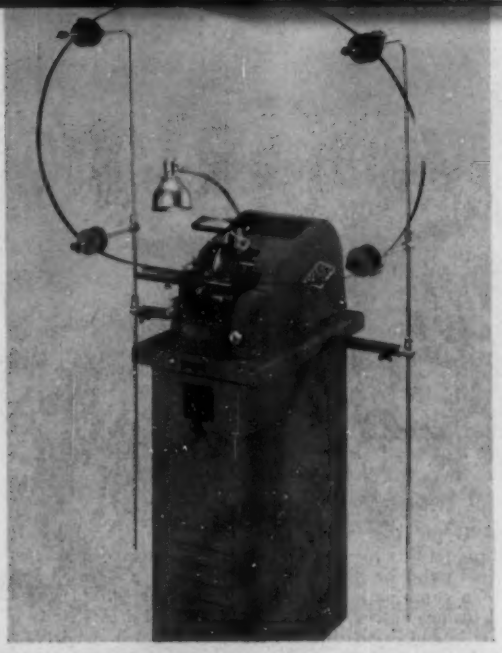
Bushing made by American Drill Bushing Co. has a thin shell of ceramic material fused onto the outer surface. The ceramic creates a heat barrier to insulate plastic potting material.



Weldon Tool Co. relieving fixture is primarily designed to produce an S-point on twist drills. In addition, this fixture can be used to sharpen taps, countersinks and burring tools.

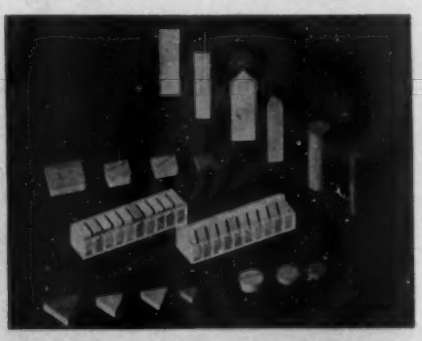


Fluid-motion wheel dresser manufactured by J & S Tool Co., Inc. dresses two angles in one continuous motion with 0.0001-inch accuracy.



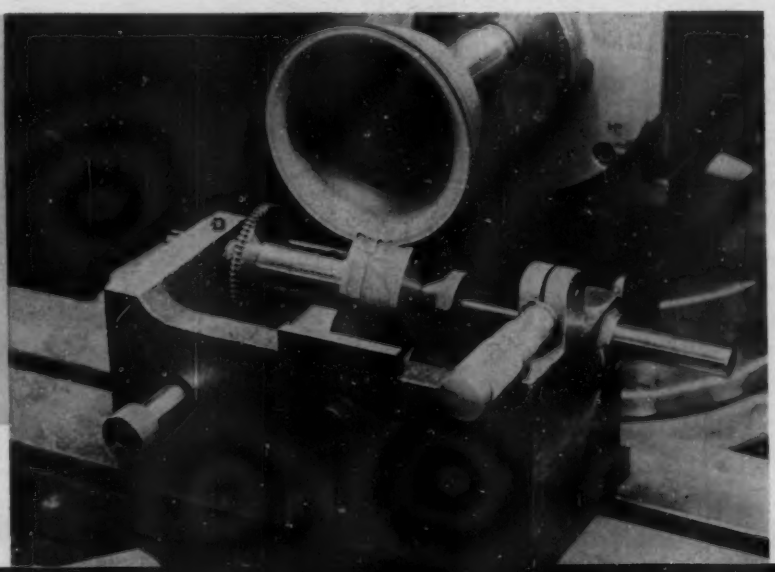
Hamco Machines Inc., automatic saw sharpener sharpens circular saws, band saws and hack saws. Circular saws up to 16 inches in diameter, band saws up to 2 inches wide and hack saws up to 2 inches wide by 18 inches long are handled on the machine.

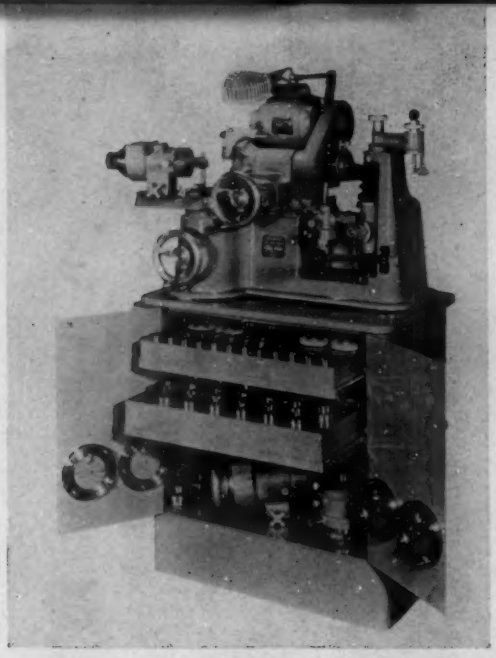
A universal grinding fixture, originally developed for grinding two-bladed, adjustable boring cutters, can be applied to all types of tool grinding. The fixture has three plane angular movement, automatic index, and a simplified brake. V-B Mfg. Co.



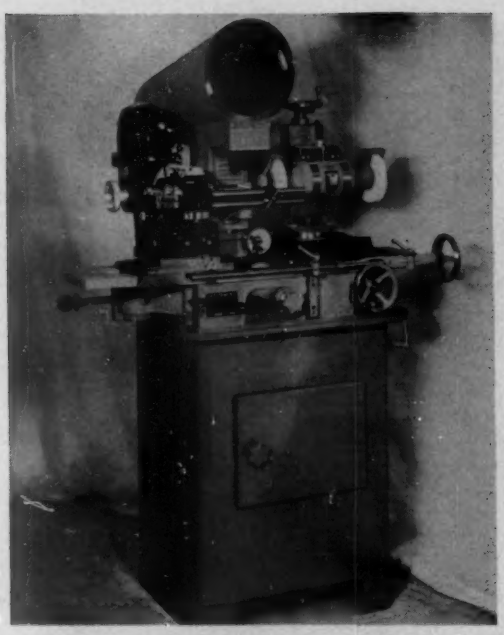
Stupalox aluminum oxide ceramic tools are available in various sizes and shapes of inserts and cemented cutting tools. Refractory properties allow for high operational cutting speeds in the machining of metals and nonmetals. The Carborundum Co.

Sharpening fixture for circular form tools made by Arthur A. Crafts Co., Inc., is designed for use on any tool cutter or surface grinder using a disk type wheel. To maintain offset distance, a micrometer spindle is used to set the fixture and position in respect to the grinding wheel.

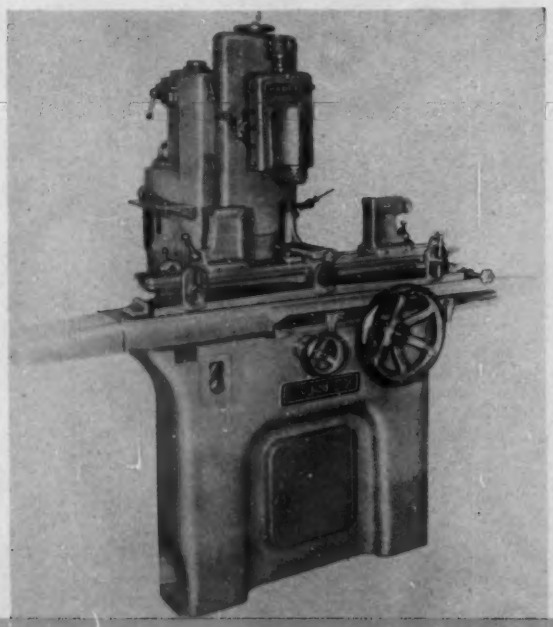




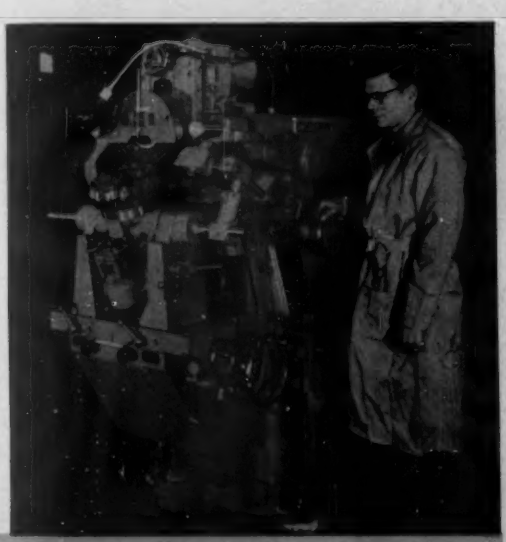
Henry P. Boggis Co. tap grinder will sharpen chamfers, flutes and spiral points. It has capacity of from No. 6 machine screw to 2½-inch hand tap. Taps are held by the shank so that they may be reconditioned after the center has been destroyed.



Optical comparator for the Royal Oak Tool and Machine Co. universal form relieving fixture grinder has 20X magnification. The comparator has a 9-inch screen with a 5-inch vernier and toolmaker's chart. Table measuring device incorporates stops for adjusting position of work to wheel.

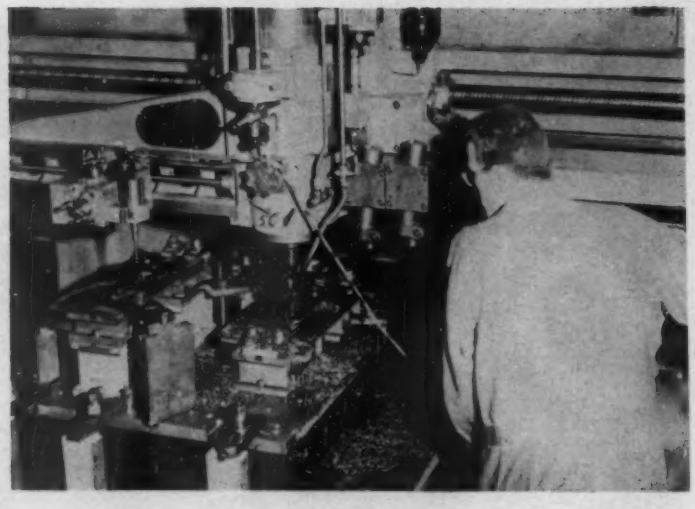


Martex cutter and reamer grinder built by Union Twist Drill Co. utilizes different types of cup wheels for grinding clearances on straight or spiral flute cutters, reamers, mills, slitting saws, counterbores and special cutters. Table travels on steel ball ways. Fixture table tilts 5 deg in either direction. Swing over table is 12½ inches in diameter. Distance between centers is 31 inches.

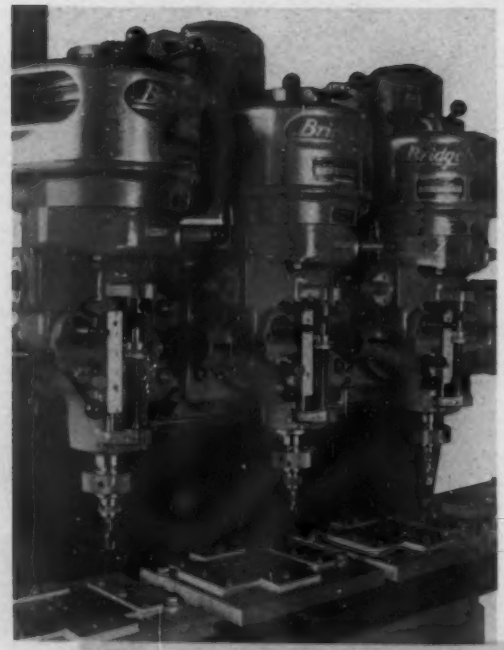


Automatic cutter grinder is cam operated and will sharpen in one stroke, face and periphery of cutters with up to 90-deg included angle. The grinder head has an adjustable grinding stroke up to 3½ inches plus 1-inch additional stroke for wheel dressing. The head has automatic downfeed for dressing the wheel after each index. The Ingersoll Milling Machine Co.

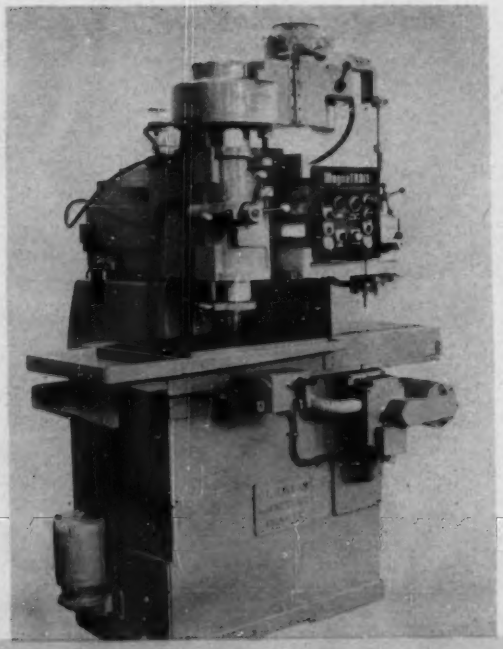
tracer machining



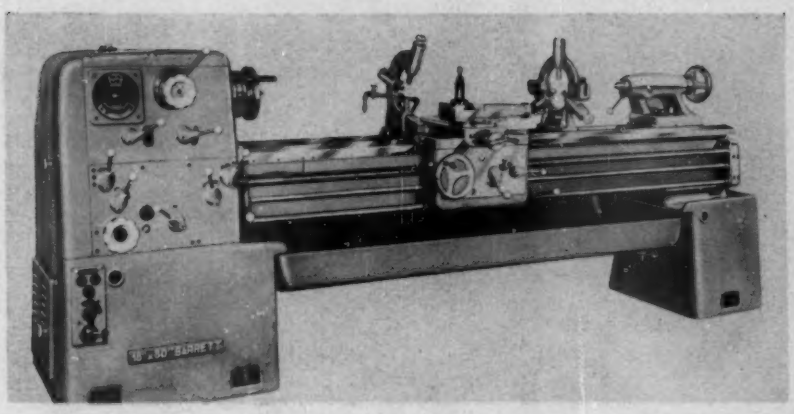
Duplimatic electronic hydraulic tracer control is manufactured by Tracer Control Co. It can be applied to standard machine tools such as milling machines, lathes and vertical boring mills. The probe is electronic while the drive is through hydraulic motor-servo valve-gear reduction units to the screws of the machine tool. Electronic circuit components are transistorized for reliability. Tracer is shown controlling Morey profiler.



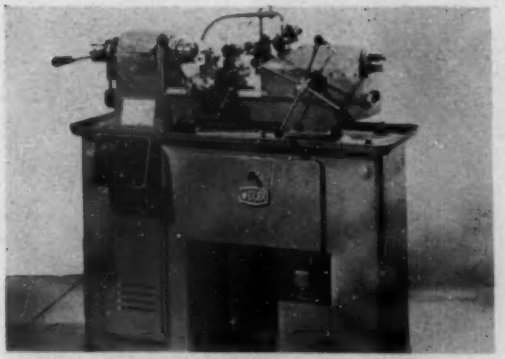
Triple-head vertical mill has Falcon Kwiklok tooling. Holders and adapters allow quick tool changing between tracer machining operations. Each tool will relocate in position within 0.0002 inch, thus assuring accurate duplication. Holders and adapters can also be applied to any kind of vertical or horizontal machine with rotary spindle for drilling, boring, milling and tapping.



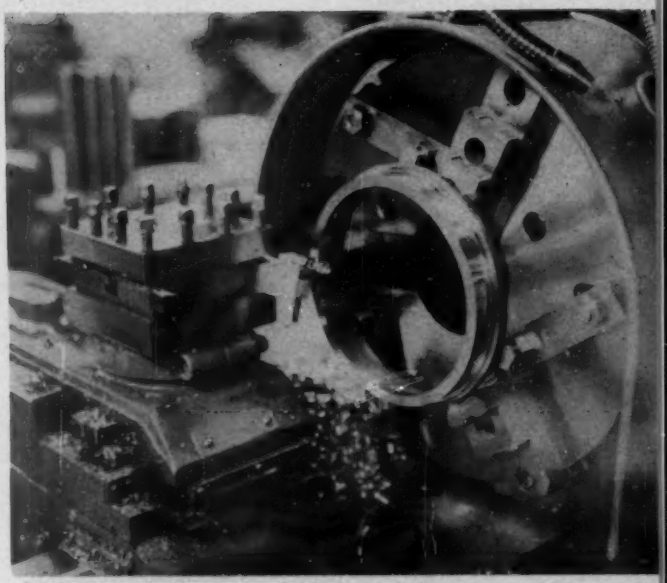
Magnetrace automatic profiler is built specifically for 360-deg profile milling under tracer control. The machine operates by following a prepared sheet steel template to reproduce complex, irregular two-dimensional shapes. Deflection of 0.0002 inch is required to activate the table and crosshead drives. Tracer follows a template at a constant preset speed of up to 80 ipm. Tooling required consists of a suitable workholding fixture, a mild steel template and tracer stylus. The machine, built by New England Machine & Tool Co., is sold by Pratt & Whitney.



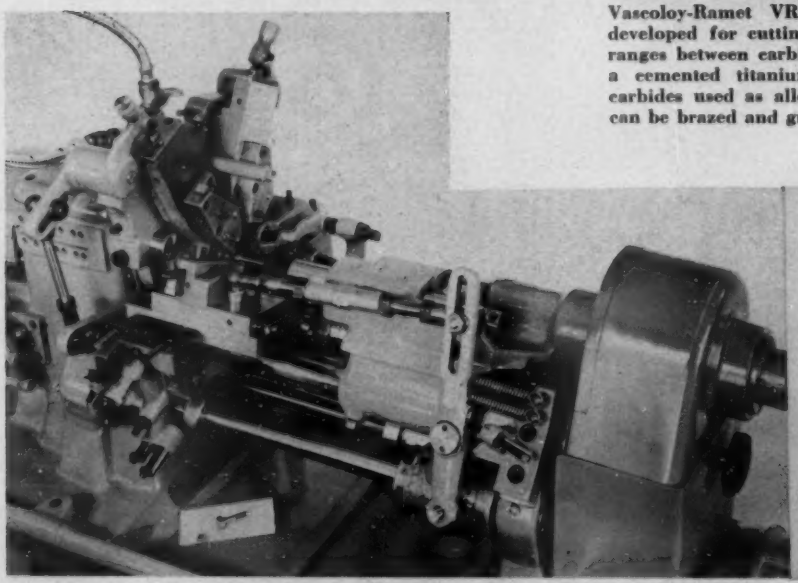
Barrett high-speed gap lathes come in sizes from 12 inches to 42-inches swing. Preselector head allows selection of speed while spindle is running. Distributed by Graham Machine Tool Co.



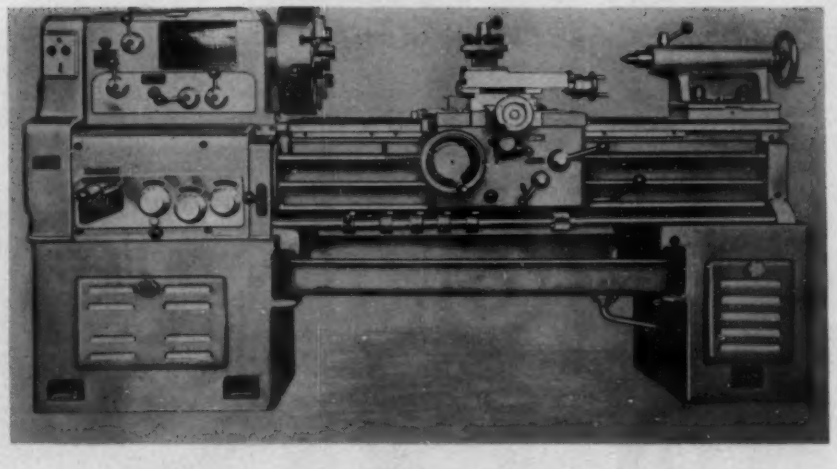
Hand turret lathe has one-inch bar capacity with twelve spindle speeds from 125 to 2800 rpm. Collet can be operated when machine is either stopped or running. For producing accurate threads, the machine can be supplied with a built-in thread-chasing attachment. The attachment works off interchangeable screw leaders and permits three different pitches to be cut with each screw leader. Distributed by Eric R. Bachmann Co., Inc.



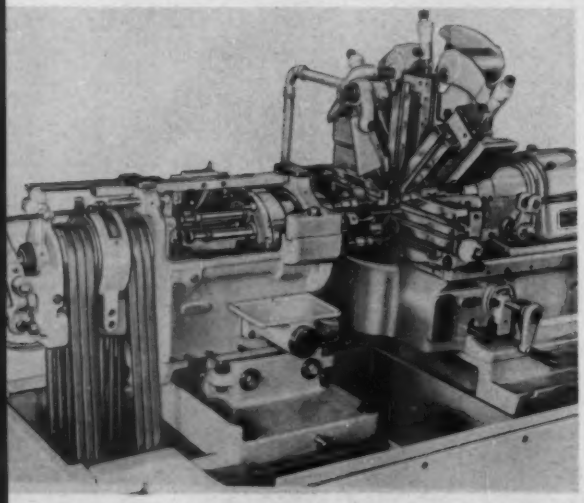
Vascoloy-Ramet VR-65 cutting tool material was developed for cutting operations at feed and speed ranges between carbide and ceramic materials. It is a cemented titanium carbide with other metallic carbides used as alloying ingredients. The material can be brazed and ground conventionally.



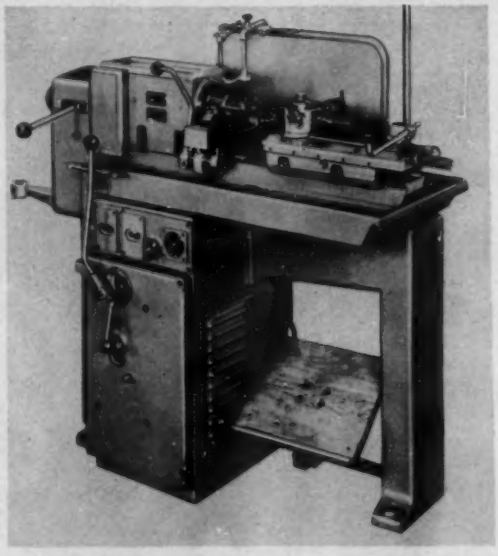
Traub single-spindle automatic screw machines can be used for various bar and secondary applications. Illustration shows model A25 with double vertical slide, longitudinal turning attachment and two-spindle drilling and threading attachment. Guthery Machine Tool.



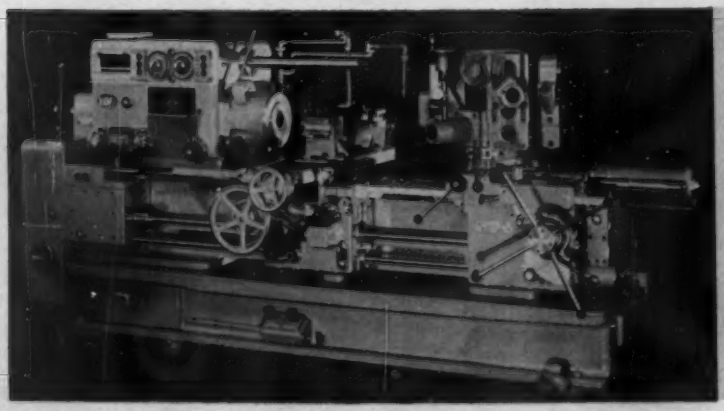
Clover engine lathe has a fully geared head, dual multidisk clutch, electromagnetic brake, dial type-change gear box. Headstock is automatically lubricated. The lathe can be equipped with hydraulic duplicating attachments, taper turning attachments and various toolholders, turrets, chucks and other accessories. Hermes Machine Tool Co., Inc.



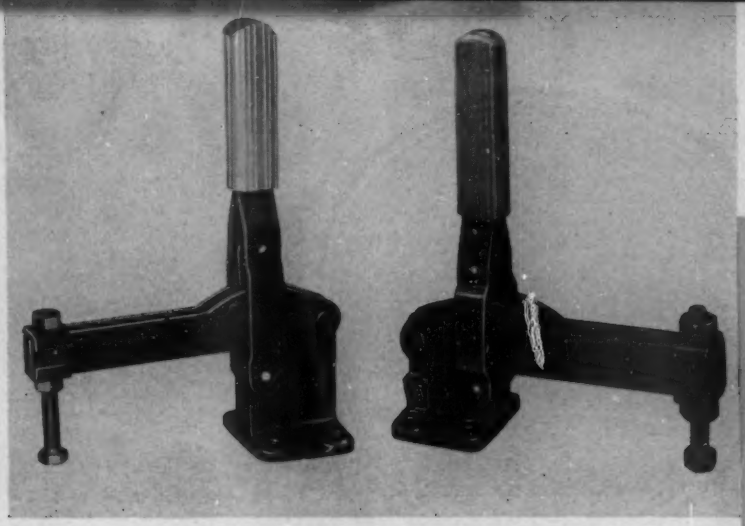
By means of sliding cam-control headstock, Swiss automatic bar machine feeds bar past five-single point tools during cycle. All tools are independently cam-controlled and adjustable with micrometer screws. Tapers, radii and other forms can be generated by combining cam movements.



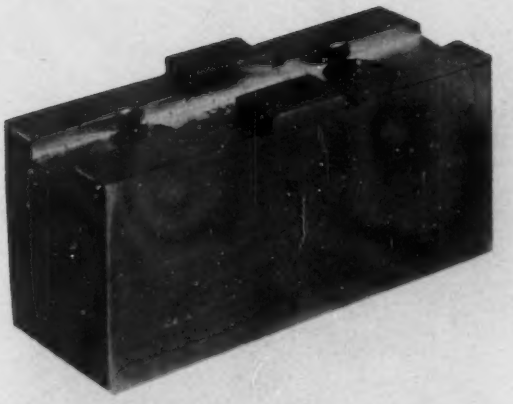
Turret lathe can be equipped with a rear turret adding eight additional tools for operations such as forming, longitudinal turning or cutoff. In place of the rear turret a cross slide with front and rear tools can also be used. The Wickman Mfg. Co.



VDF turret lathes are equipped with a peg board automatic cycle control for presetting spindle speeds, direction of rotation and feeds for a given workpiece. Individual spindle speeds and feed rates can be set by two calibrated electric preselector controls. Rudel Machinery Co.

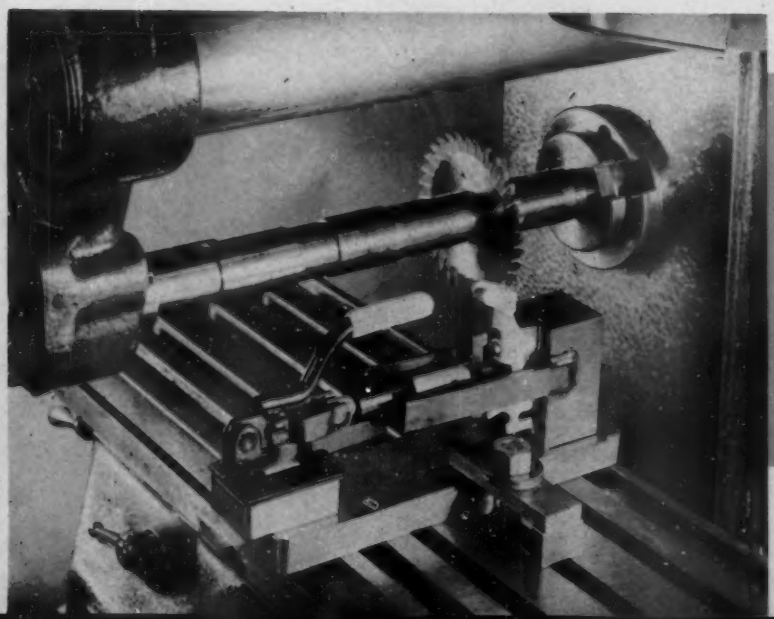


Toggle clamps made by Case Maul Mfg. Co. have alloy steel pins moving in a malleable cast linkage to give greater bearing surfaces. Hinge pins have spun heads to eliminate binding. Red vinyl handle resists oils and acids.

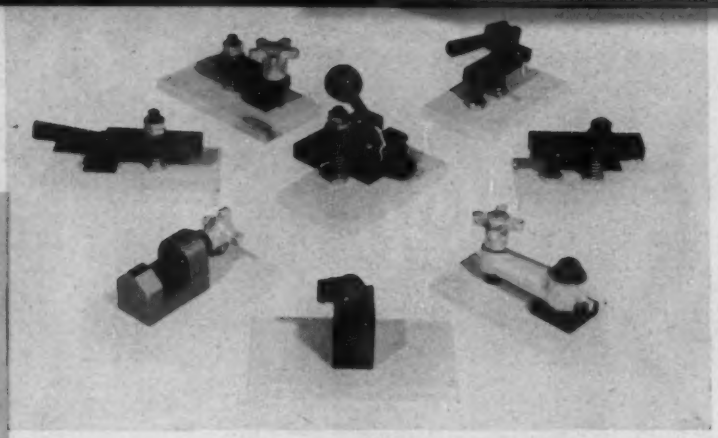


Soft-blank top jaws are manufactured by Huron Machine Products, Inc. Sizes are available for all chucks with American standard master jaws. Special top jaws are made to specifications.

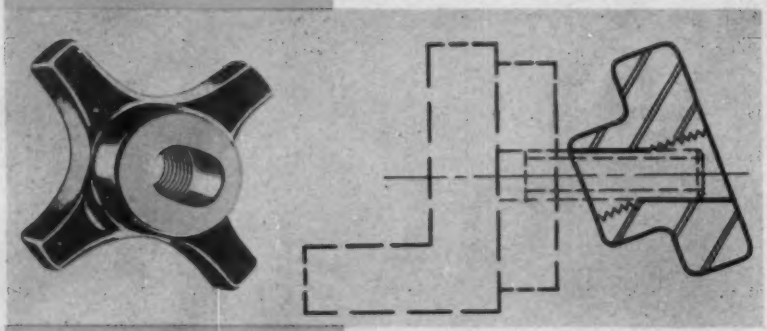
Eclipse magnetic positioner has two connected magnetic feed blocks for holding round or flat parts at any required angle. Each of the magnetic blocks has two magnetic faces energized simultaneously by the control handle. The positioner is locked by tightening the central locknut with a spanner wrench. Blocks can be dismounted from side-straps and used individually as workholders. James Neill & Co., Ltd.



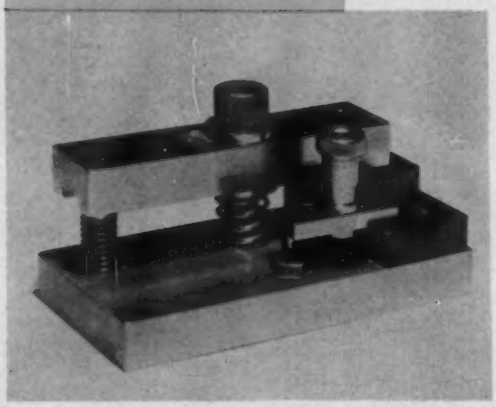
Caddy toggle clamp manufactured by Erico Products, Inc. offers a longer plunger stroke brought about by linkage design and a long bearing surface. Clamps are all welded construction. Plunger type illustrated has all-bronze plunger to resist welding spatter. Plunger end is drilled and tapped for screw. Clamping pressure is 3000 lbs.



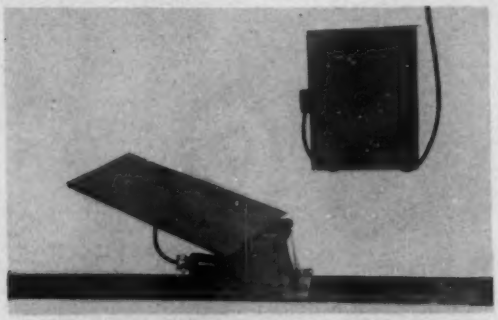
Monroe Engineering Products, Inc. offers a range of clamps in various sizes and for various working positions. Included is a redesigned lever cam clamp assembly designed to simplify installation.



Quick-acting hand knobs made by Northwestern Tools, Inc. can be slipped from stud by tilting knob. Knobs are available in cast iron and aluminum.

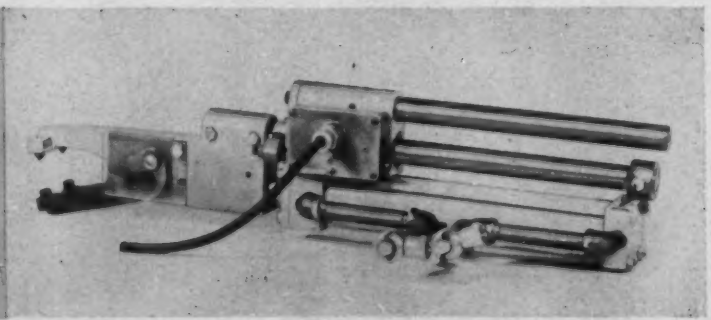


Tool clamps manufactured by PIC Design Corp. are manufactured of stainless steel hardened and heat-treated. The clamps come in sliding swivel, flat sliding, and swinging taper nose styles.



Incorporating an electric shutoff, Dual-Mag permanent magnet holds parts weighing up to 175 lbs when current is off. Hold is released when current is turned on. Unit consists of a magnet and electric control unit. By switching, unit converts to an electromagnet with a holding power of 600 lbs. Storch Products Co.

I.S.I. power roller automation jaw is used on automation equipment as an automatic gripping device. The jaw will grip sheet steel, plastic or metal assemblies for removal from dies, fabricating, or assembly tools. A safety switch controls the press and provides a limit switch for actuating additional equipment.



ASTME news

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Architect Minoru Yamasaki has encased headquarters of the Reynolds Metals Co. in the web of a gold anodized sun screen.

"The Spirit of Detroit" is epitomized in this Marshall Fredericks sculpture near the entrance to the City-County Building in downtown Detroit.

Links to Canada and the world are seen here in the Ambassador Bridge and Detroit River, major port of call for Seaway traffic.

Part of Detroit's riverfront Civic Center, with the skyline a dramatic backdrop, is seen from the air above the Detroit River. Dominating the foreground is the nearly completed Cobo Hall with the Lodge Expressway dipping under it. The mammoth exhibition hall will be the site of the ASTME'S 1962 Tool Show.

D-Day, 1960

Detroit, home town of the American Society of Tool and Manufacturing Engineers, will join forces with the Society—at 0900 o'clock Thursday, April 21—to launch the first great industrial offensive on the new decade. . . .

Dynamic city of 3,500,000 people, industrial capital of the world—Detroit means business. So will most of the 35,000 engineers and executives who participate in the ASTME's 28th Annual Conference and view the seven acres of exhibits at the Tool Show, April 21 through April 28.

Site of the Society's exposition is the Detroit Artillery Armory, W. Eight Mile Road at Hubbell.

Some Things to See In and Around Detroit

- **ASTME Exhibit**

  First on any list.

- **Canada**

  Neighbor city of Windsor across the Detroit River, world's busiest waterway. By Ambassador Bridge (with unexcelled view of Detroit skyline) or Detroit-Windsor Tunnel (world's only international tube).

- **Cultural Center**

  Out Woodward Avenue are the renowned Institute of Arts, Children's Museum, International Institute, Historical Museum, Main Library, burgeoning modernistic campus of Wayne State University. McGregor Center, on the campus, is striking example of architect Minoru Yamasaki's work.

- **Greenfield Village and Ford Museum**

  American history comes to life in 200-acre panorama in Dearborn.

- **Belle Isle**

  Out East Jefferson, take the bridge to 1000-acre wooded island park in the river.

- **Northland**

  Near the Artillery Armory off Eight Mile Road. Ultramodern shopping center. Sculptures, fountains and landscaped malls. Also Eastland.

- **Homes**

  City with the most individual homes per capita, the most trees per acre. Interesting residential sections include the five Grosse Pointe communities, Sherwood Forest, northwest Detroit, North Woodward area.

- **Civic Center**

  Seventy-two acre park of spectacular new public buildings, on the riverfront foot of Woodward. Multimillion-dollar development begun in 1951, Detroit's 250th anniversary. Includes mammoth, nearly completed Cobo Hall, which will be the site of the Society's 1962 show.

- **Cranbrook**

  Out Woodward past Birmingham to Lone Pine Road. Six famous cultural institutions and schools. Architecture by Eliel Saarinen, sculpture by Carl Milles.

- **Churches**

  Old Mariners, in the Civic Center; Father Coughlin's Shrine of the Little Flower, Royal Oak; Fort Street Presbyterian with its graceful spire; all denominations represented by the 92 national groups who help to people Detroit.

- **Lafayette Redevelopment Center**

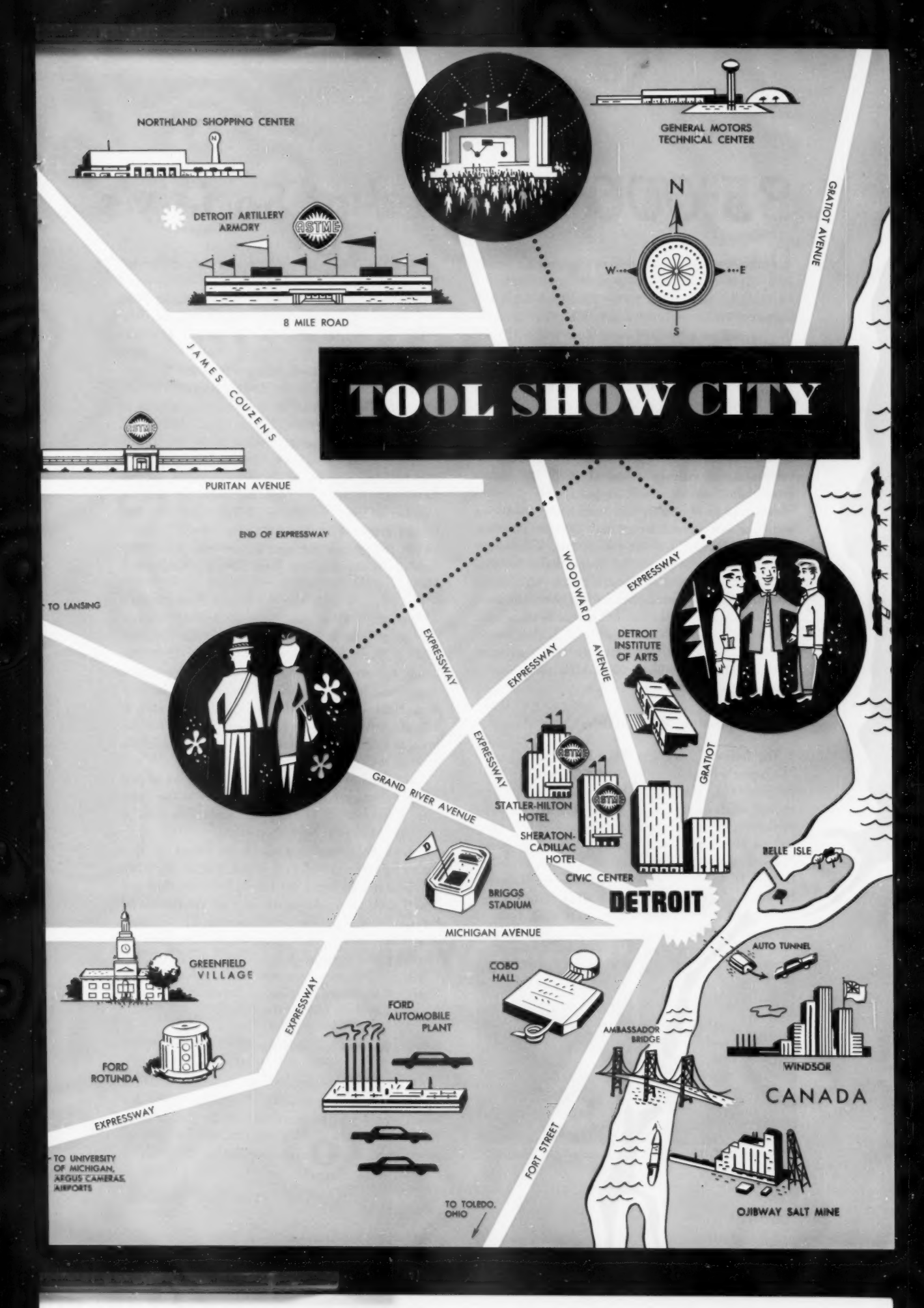
  Near downtown, tower apartments and town houses replacing slums.

- **Industry**

  Not only the automotive capital of the world, Detroit area produces many things besides automobiles; for example, business machines (Burroughs Corp.); pharmaceuticals (Parke Davis); whiskey (Hiram Walker); steel (Great Lakes Steel Corp.).

- **Expressways**

  Nine million dollar per mile superroad system linking the heart of downtown with the east, west and northwest suburbs.


TOOL SHOW CITY
NORTHLAND SHOPPING CENTER
GENERAL MOTORS TECHNICAL CENTER
DETROIT ARTILLERY ARMORY
ASTME
8 MILE ROAD
GRATIOT AVENUE
N
W
E
S
JAMES COUZENS
PURITAN AVENUE
END OF EXPRESSWAY
TO LANSING
WOODWARD AVENUE
EXPRESSWAY
DETROIT INSTITUTE OF ARTS
GRAND RIVER AVENUE
STATLER-HILTON HOTEL
SHERATON-CADILLAC HOTEL
CIVIC CENTER
DETROIT
BRIGGS STADIUM
BELLE ISLE
MICHIGAN AVENUE
AUTO TUNNEL
GREENFIELD VILLAGE
COBO HALL
FORD AUTOMOBILE PLANT
FORD ROTUNDA
AMBASSADOR BRIDGE
WINDSOR
CANADA
TO UNIVERSITY OF MICHIGAN, ARGUS CAMERAS, AIRPORTS
FORT STREET
TO TOLEDO, OHIO
OJIBWAY SALT MINE

35,000 Expected at Society's

DETROIT HAS ALWAYS acted as a magnet for young men eager to acquire know-how and establish a foothold in one of the many phases of American industry which the city exemplifies. Its magnetic quality will be evidenced once more when ASTME opens its 28th Annual Engineering Conference and Exhibit on April 21. The men coming to Detroit for this meeting and show probably have already established their foothold, and are members of manufacturing firms actively participating in America's industrial growth. But they are equally as anxious as the novice to learn of the latest developments in manufacturing which both the conference and tool show will be publicizing.

A salute to Michigan will launch the week-long activities. A luncheon at the Detroit Artillery Armory, which will house the exhibit, will feature the director of the office of space flight development, National Aeronautics and Space Administration, Dr. Abe Silverstein. Michigan Gov. G. Mennen Williams, Detroit Mayor Louis C. Miriani and ASTME President Wayne Ewing will also be on hand for this formal opening of the conference and exhibit. The $15 million, 500-exhibit tool show is expected to attract 35,000 people.

Forum Planned on Public Affairs

The following day a public affairs forum on the "Engineer's Responsibility to the Community" will be presented. Thomas R. Reid, civic and governmental affairs manager, Ford Motor Co., will be moderator of the panel. Other members of the group will be Herschel C. Atkinson, executive vice president of the Ohio Chamber of Commerce; Gov. George D. Clyde of Utah; Dr. Stanley J. Idzerda, Honors College director at Michigan State University; and Edwin L. Yates, personnel staff, General Motors Corp. The forum is scheduled for 2:15 pm.

Rudolph F. Bannow

Dr. Abe Silverstein

"Creating a Climate for Prosperity and Progress" is the topic chosen by Rudolph F. Bannow, president of the National Association of Manufacturers, who will be guest speaker at an Industrial Progress Dinner to be held the same day as the public affairs forum.

The man who caused such a stir at the Society's semiannual meeting in St. Louis last October, Dr. Ross M. Trump, dean of the graduate school of business administration, Washington University, will be back this time as speaker at the Leadership Conference Luncheon on Saturday, the first day of the two-day conference. Other speakers at the Leadership Conference will be John W. Brown, member of the Ohio House of Representatives and former governor of that state, and Dale J. Madden, owner and general manager of Leadership Training Institute sponsoring the Dale Carnegie Courses in Michigan.

Greenfield Village and the Henry Ford Museum in Dearborn, Mich., will provide ASTME convention-goers with an unusual course in the appreciation of American history and progress. Both husbands and wives are invited to take the Panorama Americana tour of the village and museum on Sunday, April 24. A special display called "Profile of Manufacturing Progress" has been set up for the tour. It will be aimed directly at the interest of the visiting tool and manufacturing engineers.

Canadians at the conference will have an opportunity to compare notes when they meet at the Canadian Breakfast on Monday morning. The time is 7:30 am at the Statler Hilton Hotel.

An all-day closed session of the House of Delegates will start at 9 o'clock Monday morning. When the delegates do break for lunch, however, they will hear Dr. Allen V. Astin, director of the Bureau of Standards, deliver his prize-winning Eli Whitney Memorial Lecture on "The Basic Standards of Physical Measurement."

All ASTME members are invited to attend the Board of Directors meeting on Tuesday. The meeting will last from nine to five.

Economists to Look at Future

At noon of this same day a Business Outlook Luncheon has been scheduled. Attendance at this affair, which will be presided over by Editor John W. Greve of THE TOOL ENGINEER, will be by invitation only. A panel of authorities in the fields of

Annual Conference and Exhibit

economics, finance, manufacturing, and retailing will be interviewed by business editors of the metropolitan Detroit newspapers.

Those men present at the annual meeting who have held the office of president of ASTME in past years will gather together at a Past Presidents Luncheon on Tuesday also.

The 28th Annual Meeting of the membership and the installation of the new national officers will take place at the Annual Banquet on Wednesday evening at the Statler Hilton.

When not attending Society-sponsored events, ASTME members and wives can spend their free time discovering dynamic Detroit. Proving a nice balance for the major industrial attractions the city has to offer are the countless sights of a lighter nature that should appear on any tourist's list of things to do and see.

Detroit is not a city composed completely of muscle and brawn. Renowned architects Yamasaki and Saarinen, sculptors Carl Milles and Marshall Fredericks, and artist Diego Rivera have found it the perfect setting in which to execute their masterpieces. Medical men and educators have brought it fame through their research and discoveries. The area's parks and waterways have contributed to the outdoor pleasure of millions of Americans. Speaking of outdoors, the average city temperature in April is 46. However, fast-moving and pace-setting though it may be, Detroit has never lost its atmosphere of casualness and informality. These are the qualities that distinguish it from any other city of its size and potential.

Whether they are inspecting a new machine at the tool show, listening to a technical speaker at one of the 35 sessions, watching the cars roll off an assembly line, or marveling at the architectural spectacle of the Civic Center, April in Detroit should prove an unforgettable experience for ASTME members and their families. At least, the Detroit Host Committee, made up of members from 11 area chapters, and the Honorary Host Committee, consisting of automotive firm presidents Henry Ford II, L. L. Colbert, John F. Gordon, and George Romney, and Bendix Aviation's M. P. Ferguson, have done their best to make it so.

Honor Awards Winners Revealed

Winners of ASTME's highest laurels, the 1960 Honor Awards, will receive their citations and plaques at a dinner in Detroit's Sheraton-Cadillac Hotel on Saturday evening, April 23. An advance announcement has yielded the following list:

Progress Award—*Ralph H. Cordiner*, chairman of the board, General Electric Co.

Engineering Citation—*Edward E. Griffiths*, consulting engineer.

Joseph A. Siegel Memorial Award—*Frank Martindell*, consulting engineer.

Education Award—*Charles S. Mott*, president, Charles Stewart Mott Foundation.

Research Medal—*Dr. Norbert Wiener*, professor of mathematics, Massachusetts Institute of Technology.

Gold Medal—*Edward C. Varnum*, head of operations research, Barber-Colman Co.

daily schedule of events

28th annual engineering conference and exhibit

where:
Detroit, Michigan

when:
Thursday, April 21 through Thursday, April 28

tool show:
Detroit Artillery Armory, 15000 West Eight Mile Road, Oak Park

technical sessions:
Sheraton-Cadillac Hotel, Washington Blvd. and Michigan Ave.

annual meeting and special events:
Artillery Armory, Sheraton-Cadillac or Statler Hilton,
1539 Washington Blvd., as listed.

registration:

Central registration and headquarters for all visitors to the Conference and Exhibit will be on the Ballroom floor of the Statler Hilton Hotel. In addition, registration will be conducted at the Sheraton-Cadillac and Armory.

tool show hours:

Thursday through Saturday	9 am to 6 pm
Monday and Tuesday,	1 pm to 10 pm
Wednesday and Thursday,	9 am to 6 pm

general information:

Program headquarters for all technical program speakers and participants will be located in Parlor C, Sheraton-Cadillac.

Shuttle bus service between downtown hotels and the Artillery Armory will be maintained during Tool Show hours.

Ladies headquarters and lounge will be open throughout the Conference in Parlors B and C of the Statler Hilton.

An ASTME Center located in the Armory will operate during show hours. Complete information and literature on the Society will be available.

host chapters:

Detroit C-1, Toledo C-9, Grand Rapids C-38, Windsor C-55, Saginaw Valley C-68, Oakland County C-69, Ann Arbor Area C-79, Jackson C-87, Lansing C-109, Muskegon C-111 and Macomb C-142.

share the ride!

A sociable and inexpensive way to visit the Society's 1960 Engineering Conference and Exhibit is to share the ride. The Chapter Services Committee of the Detroit Host Committee is encouraging members within a radius of 200 miles to get together and plan transportation pools.

The committee wants to help. If it is aware of a group's plans—estimated time of arrival; whether by bus, car, train or plane; length of stay—the committee will furnish a representative to welcome the visitors and help them find their way around. For help and information, contact the committee chairman, Edward Till, 19807 Mauer, St. Clair Shores, Mich.

CALENDAR

of special events during show

thursday april 21

Michigan Day Luncheon

11:30 a.m. Artillery Armory

Inaugural ceremonies for ASTME's week-long "Tooling for Productivity" Conference and Exhibit. Participants: ASTME President Wayne Ewing, Michigan Gov. G. Mennen Williams, Detroit Mayor Louis Miriani. Keynote speaker: Dr. Abe Silverstein, director, Office of Space Flight Development.

friday april 22

Public Affairs Forum

2:15 p.m. Sheraton-Cadillac Hotel

Subject: "Engineer's Responsibility to the Community." Moderator: Thomas R. Reid, civic and governmental affairs manager, Ford Motor Co. Panel members: Herschel C. Atkinson, executive vice president, Ohio Chamber of Commerce; George D. Clyde, governor of Utah; Dr. Stanley J. Idzerda, Honors College director, Michigan State University; Edwin L. Yates, personnel staff, General Motors.

Industrial Progress Dinner

7 p.m. Sheraton-Cadillac Hotel

Speaker: Rudolph F. Bannow, president, National Association of Manufacturers, on "Creating a Climate for Prosperity and Progress." Reception and social hour. Tickets $10.

saturday april 23

Leadership Conference Luncheon

12:15 p.m. Statler Hilton Hotel

Speaker: Dr. Ross M. Trump, dean, Graduate School of Business Administration, Washington University, St. Louis.

Honor Awards Dinner

6:15 p.m. Sheraton-Cadillac Hotel

(See Page 199 for names of award winners.)

monday april 25

Canadian Breakfast

7:30 a.m. Statler Hilton Hotel

House of Delegates

9 a.m. to 5 p.m. Statler Hilton Hotel

Eli Whitney Memorial Lecture

12:15 p.m. Statler Hilton Hotel

Speaker: Dr. Allen V. Astin, director, Bureau of Standards, on "The Basic Standards of Physical Measurement." Luncheon $4.

tuesday april 26

Board of Directors

9 a.m. to 5 p.m. Statler Hilton Hotel

28th Annual Meeting. All members welcome to attend.

Business Outlook Luncheon

12 noon Statler Hilton Hotel

Presiding: John W. Greve, editor of THE TOOL ENGINEER. Business editors of metropolitan press will interview panel of authorities in the fields of economics, finance, manufacturing and retailing. Attendance by invitation.

Past Presidents Luncheon

12:30 p.m. Statler Hilton Hotel

wednesday april 27

Annual Banquet

6 p.m. Statler Hilton Hotel

28th Annual Meeting of the membership. Installation of new national officers. NO BANQUET SPEAKER. Tickets $8.

thursday april 21

Dimensional Metrology Seminar
Morning Session

8:30 a.m. Registration

9:15 a.m. Grand Ballroom

"Can You Measure It?" (Paper No. 239), by Dr. Lewis V. Judson, physicist, Office of Weights and Measures, National Bureau of Standards.

10 a.m.

"Some Fundamentals of Modern Dimensional Metrology" (Paper No. 240), by Irvin H. Fullmer, chief, Engineering Metrology Section, Optics and Metrology Div., National Bureau of Standards.

Chairman: Russell E. Bauer, president, Cadillac Gage Co.

Dimensional Metrology Seminar
Afternoon Session

3:15 p.m.

"Gaging, Yesterday and Today" (Paper No. 241), by Thomas W. Mitchell, quality control manager; and Donald H. Mueller, chief inspector, The DoAll Co.

3:45 p.m.

"Master Gages, Their Manufacture, Use, and Care" (Paper No. 242), by Michael C. Curtis, general foreman, Tool Inspection Dept., The Timken Roller Bearing Co.

4:15 p.m.

Discussion

Chairman: Raymond C. W. Peterson, president, Peterson Engineering Co.

Medicine - Surgery - Engineering

3:30 p.m. Founders Room

"The Engineer in Medicine" (Paper No. 299), by Dr. Carl W. Walter (F.A.C.S.), associate clinical professor of surgery, Harvard Medical School; surgeon, Peter Bent Brigham Hospital.

"Rehabilitation Needs the Engineer" (Paper No. 300), by Willis C. Gorthy, C.E. director, Institute for the Crippled and Disabled.

"Tooling for the Handicapped—A Challenge to Engineers" (Paper No. 301), by John W. Greve, editor, THE TOOL ENGINEER.

Chairman: Karl G. Nowak, factory superintendent, Fenwal, Inc.

Dimensional Metrology Seminar
Evening Session

7:30 p.m.

"Gage Blocks, Industry's Standard of Measurement" (Paper No. 243), by Ermand L. Watelet, director of design, Industrial Products Div., Brown & Sharpe Mfg. Co.

8:15 p.m.

"The Pros and Cons of Air Gaging" (Paper No. 244), by David B. Kirk, chief engineer, Moore Products Co.

8:45 p.m.

Discussion

Chairman: Henry C. Daum, manager, Machining Process Dept., Manufacturing Engineering Office, Ford Motor Co.

friday april 22

Dimensional Metrology Seminar
Morning Session

9:15 a.m.

"Modern Measuring Instruments—Electric (Electronic) Gages" (Paper No. 245), by Fred W. Witzke, manager, sales engineering, Cleveland Instrument Co.

9:50 a.m.

"Optics in Gaging and Tooling Today and Tomorrow" (Paper No. 246), by E. J. Schneider, vice president, Div. of Engineering and Scientific Instrumentation, Engis Equipment Co.

Chairman: Col. William J. Darmody, technical assistant to president, The Sheffield Corp.

10:30 a.m.

Coffee Break

10:45 a.m.

Discussion

12 Noon

Luncheon (Informal—no speaker)

Some Production Considerations

9:30 a.m. Founders Room

"The Turret Drill and Tape-Control: An Unbeatable Cost-Cutting Universal Production Tool" (Paper No. 277), by J. L. Burg, vice president in charge of sales and engineering, Burg Tool Mfg. Co., Inc.

"Some Quality Considerations in the Design of Automatic Assembly machines" (Paper No. 263), by Arthur J. LaRue, associate engineer, International Business Machines Corp., Burlington, Vt., plant.

Chairman: Kurt O. Tech, vice president in charge of engineering, The Cross Co.

Techtour "Gun Drilling I" (See Plant Tour #3.)

9:45 a.m. Crystal Ballroom

"Gun Drilling in Production" (Paper No. 252), by Joseph Savage, production engineer, the Power Train Group, Chrysler Corp.

"Pressure-Coolant Drills and Reamers for Precision Hole Production" (Paper No. 267), by Herbert Gregg, chief engineer, Star Cutter Co.

"Selection and Use of Cutting Fluids for Gun Drilling and Reaming" (Paper No. 275), by Russell F. Below, staff engineer, Industrial Technical Div., Products Dept., Socony Mobil Oil Co., Inc.

"Machine Tool Considerations in Multiple Gun-Drilling and Gun-Boring Operations (Paper No. 276), by Eugene R. Delamater, vice president, Foote-Burt Co.

Chairman: George R. Squibb, president, Automotive Conversion Corp.

Dimensional Metrology Seminar Afternoon Session

2 p.m.

"Numerically Controlled Inspection Techniques" (Paper No. 247), by J. Stewart Broatch, sales application engineer, Pratt & Whitney, Inc.

2:45 p.m.

"What's New on the Gaging Horizon?" (Paper No. 248), by Louis F. Polk, Jr., assistant vice president and manager of Instruments and Systems Div., The Sheffield Corp.

Chairman: Charles H. Good, plant manager, Micrometrical Mfg. Co.

3:15 p.m.

Discussion

7:00 p.m.

Industrial Progress Dinner
Speaker: Rudolph F. Bannow, president, National Association of Manufacturers.

Ordnance Tooling

8:30 p.m. Founders Room

"Ordnance Machine-Tooling Policies" (Paper No. 273), by Fred Wittber, assistant to the chief, Industrial Div., Ordnance Weapons Command; and John F. Pauls, deputy chief, Industrial Mobilization Branch, Industrial Weapons Command.

"Pilot Line Tooling of Small Arms Weapons at Springfield Armory (Paper No. 274), by Thaddeus J. Brusnicki, project engineer M-14 Rifle; and August R. Brus, chief, Methods Section (Production Engineering), Springfield Armory.

Chairman: Eugene Makie, manager-manufacturing engineering, Utica Div., Curtiss-Wright Corp.

Techtour "Gun Drilling II"

8:30 p.m. Crystal Ballroom

Panel participants: Joseph Savage, production engineer, the Power Train Group, Chrysler Corp.; Herbert Gregg, chief engineer, Star Cutter Co.; Russell F. Balow, staff engineer, Industrial Technical Div., Products Dept., Socony Mobil Oil Co., Inc.; Eugene R. Delamater, vice president, Foote-Burt Co.; and Glen Johnston, vice president manufacturing, Star Cutter Co.

Chairman: George R. Squibb, president, Automotive Conversion Corp.

plant tours for friday

Tour #1—8:30 a.m. Ford Stamping and Final Assembly Plant (River Rouge).

Buses leave from Statler and return to Armory. Limit 100 visitors. The "Rouge," designed to be a manufacturing unit almost entirely independent of outside suppliers, is situated on a tract 1½ miles long and 1 mile wide, covering a 1200-acre strip. Over 63,000 people staff the plant and in a single day over 6800 trucks, 40,000 automobiles and 150,000 pedestrians pass through the gates. New cars are driven away from the final assembly line every minute.

Tour #2—8:30 a.m. Ex-Cell-O Corp.

Buses leave from Statler and return to Armory. Limit 50 visitors. Participants will see heavy machinery finishing large cast and welded components for precision machines; the manufacture of broaches, cutting tools and counterbores from bar stock through heat treat to the finished tool; and the manufacture and assembly of precision boring machines, precision thread grinders, tape-control and milk-packaging machines.

Tour #3—1 p.m. Star Cutter Co. *(Techtour.)*

Buses leave from Statler and return there. Limit 125 visitors—must participate in Techtour sessions on "Gun Drilling" to attend. The plant has 50,000 sq ft devoted to the manufacture of special milling cutters. Such products as the accurate unground-form hob, Starbore gun drills, pressure-coolant reamers and other special items for the industry will be seen.

Tour #4—1 p.m. Chrysler Corp. of Canada

Buses leave from Armory and return to the Statler and Armory. Limit 100 visitors. Participants will see one of the most complete composite automobile plants covering 30 acres and containing over 7½ miles in conveyors. Also various models assembled on one line.

saturday april 23

Standardization and Machine Design

9:15 am — Founders Room

"Standardization of Processes, Tooling and Tool Components as Applied to Eclipse—Pioneer" (Paper No. 294), by David French, assistant factory manager, Eclipse—Pioneer Div., Bendix Aviation Corp.

"On the Efficiency of Machine Tool Suspension" (Paper No. 264), by Dr. Miroslav Sadowy, assistant professor of mechanical engineering, College of Engineering, Marquette University.

Chairman: Carl J. Oxford, Jr., director of research, National Twist Drill and Tool Co.

Engineering Enrollments

9:30 am — Crystal Ballroom

"Some Significant Aspects of Current Engineering Enrollments" (No Paper), by William Thurlow Alexander, dean of engineering, Northeastern University.

"Trends in Engineering Enrollments" (No Paper), by Leroy K. Wheelock, executive secretary, Engineering Manpower Commission, Engineers Joint Council.

Chairman: Clyde L. Fanning, assistant department chairman, General Motors Institute.

Engineering Curriculum

2:30 pm — Founders Room

"Engineering Education for the Future" (No Paper), by Dr. William L. Everitt, dean, College of Engineering, University of Illinois.

"Tool Engineering—Our Place in Education" (Paper No. 293), by Frederick Preator, head, Dept. of Tool Engineering, Utah State University.

Chairman: Arthur F. Gould, head, Dept. of Industrial Engineering, Lehigh University, and chairman of the ASTME National Education Committee.

Improvements Sparked by Research

2:45 pm — Crystal Ballroom

"A Tool Dynamometer for Electrolytic Grinding Research" (Paper No. 287), by Prof. Reno R. Cole, Dept. of Engineering; and Robert A. Needham, associate professor of engineering, University of California.

"Improving Welding Techniques in a Medium-Sized Plant" (Paper No. 265), by J. L. Aldred, chief engineer, Sherman Products, Inc.

Chairman: Richard T. Thornton, general manufacturing manager, Hardware and Accessories Div., Ford Motor Co.

sunday april 24

"PANORAMA AMERICANA"

The Detroit Host Committee invites you to attend . . .

A Tour of Greenfield Village and the Henry Ford Museum

Including

"PROFILE OF MANUFACTURING PROGRESS"

an exhibit designed especially for ASTME visitors

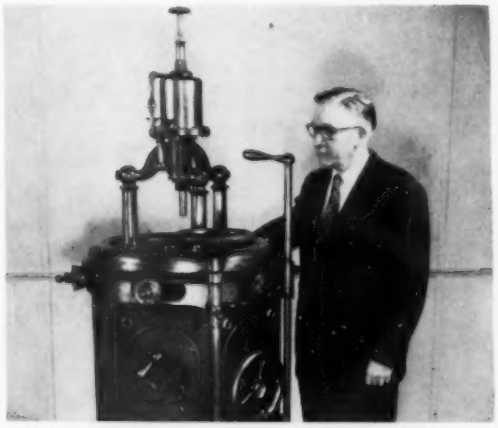
10:30 am - 3:30 pm — **Sunday, April 24**

The Henry Ford Museum and Greenfield Village contain
one of the greatest collections of Americana in existence,
tracing three centuries of American life in the development of its arts and skills.
Exhibits collected especially for our tour will highlight
the history of American industrial crafts.

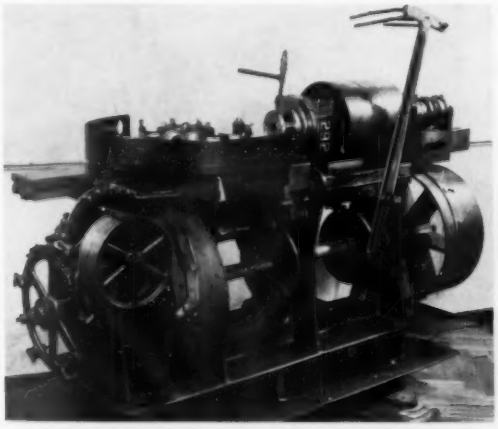
Tickets $3.75 per person

(includes transportation to and from Greenfield Village
and admission to both the Museum and Village).

Visitors can stroll along five blocks of early American shops at the Henry Ford Museum. The John F. Brown Gun and Locksmith Shop, dating from the late 18th to the early 19th century period, should be of special interest to ASTME members. Some of the shops are open with actual demonstrations of early crafts and skills being carried on. The museum, which adjoins Greenfield Village, houses a 14-acre exhibit.



The Henry Ford Museum in Dearborn has arranged a special ASTME exhibit to tell the story of American mass production. Here, Frank R. Davis, curator of communications at the museum, stands beside an 1890 milling machine. The machine could mill valve stuffing boxes on six sides in one operation.



This automatic screw machine on display at the museum, also built about 1890, was designed by C. M. Spencer, New England inventor and master mechanic. After a few years, Spencer's machines were built by the Hartford Machine Screw Co., later taken over by the Pratt & Whitney Corp.

monday april 25

Value Analysis I

9:15 a.m. Grand Ballroom

"The Tool Engineer's Role in Effective Product Planning" (Paper No. 266), by C. Farnworth, manager, Product & Program Analysis, Corporate Planning Staff, Chrysler Corp.

Chairman: Albert Underwood, Jr., quality control manager, Windsor Manufacturing Operations, Ford Motor Co. of Canada.

Communications

9:30 a.m. Crystal Ballroom

"The Impossibility of Communication" (Paper No. 302), by Patrick M. Beatts, Data Processing Division of the International Business Machines Corp.

Chairman: Carl S. Abbott, president, J. N. Fauver Co., Inc.

Metal Cutting I

9:45 a.m. Founders Room

"Machining of Steel Casting Surfaces" (Paper No. 249), by Frank L. Brugger, product sales manager, Kennametal, Inc.

"Milling Zircaloy—Recommendations from Research" (Paper No. 250), by William Pentland, research supervisor, The Cincinnati Milling Machine Co.

Chairman: H. J. Siekmann, manager-market development and research, Metallurgical Products Dept., General Electric Co.

Value Analysis II

2:30 p.m. Founders Room

"Operation Product Analysis and Cost Estimating" (Paper No. 268), by W. L. Shepherd, manager, chassis, electrical and truck estimating, Corporate Planning Staff, Chrysler Corp.

Chairman: Julian J. VanMaele, partner, Allied Engineering Co.

ASME Exchange Papers

2:45 p.m. Crystal Ballroom

"Engineering Application of Digital Computers" (Paper No. 278), by H. D. Irwin, mechanical equipment consultant, E. I. du Pont de Nemours & Co., Inc.

"New Developments in the Theory of the Metalcutting Process: The Ploughing Process in Metalcutting" (Paper No. 251), by Paul Albrecht, research associate, Physical Research Dept., The Cincinnati Milling Machine Co.

Chairman: Robert E. McKee, sales manager, R. K. LeBlond Machine Tool Co.

Radiation and the Tool Engineer

7:30 p.m. Crystal Ballroom

"The Proposed Use of Radioisotopes for Die Life Tests" (Paper No. 269), by Donald Peckner, associate editor, *Materials in Design Engineering*.

"Sonic Energy as a Production Tool" (Paper No. 270), by Dr. Thomas J. Bulat, manager, Sonic Energy Applications and Research Laboratories, Bendix Aviation Corp.

Chairman: Harold N. Bogart, manager, Process Development Dept., Ford Motor Co.

Metal Cutting II

7:45 p.m. Founders Room

"Production Application of Ceramics to the Machining of High-Strength Steels" (Paper No. 253), by John W. Rodd, experimental methods project leader; and Dominic T. Bisceglia, section chief, Ordnance Corps, Watervliet Arsenal.

"Precision Forming Techniques—Cold Swaging" (Paper No. 290), by Philip A. B. Carbonaro, director of Rodman Laboratory; and Samuel Valencia, also of the Rodman Laboratory, Watertown Arsenal.

"The Effect of Drill Symmetry on Performance (Paper No. 254), by W. Andrew Haggerty, research supervisor, The Cincinnati Milling Machine Co.

Chairman: Wayne Blackmun, manager, production engineering, Power Systems Works, Thompson-Ramo-Wooldridge.

plant tours for monday

Tour #5—8:30 a.m. Ojibway Salt Mines of Canada.

Buses leave from Statler and return to Statler. Limit 100 visitors, proof of citizenship required. The salt mine, located near Windsor, Ont., Can., is 1080 ft underground. The mine occupies a 32-acre city of solid rock salt where the temperature is 60 F the year round. The present production rate is 500 tons per hour, or 1,000,000 tons per year.

Tour #6—8:30 a.m. Detroit Diesel Engine Div., General Motors Corp.

Buses leave from Statler and return to Statler. Limit 100 visitors. This plant produces diesel engines with ratings from 20 to 1650 hp. Included will be the latest in transfer machines, producing parts for a wide variety of assemblies.

Tour #7—1 p.m. Chrysler Corp., Trenton Engine Plant.

Buses leave from Statler and return to Armory. Limit 100 visitors. Under one roof, covering 1,250,000 sq ft, ten different engines are built to 159 modifications and assembled on only two lines. Latest developments in producing the inclined six-cylinder engines that power the Dodge Dart and Valiant automobiles.

tuesday april 26

Automation—Numerical Control I

9:15 a.m. Crystal Ballroom
Sheraton-Cadillac Hotel

"Introduction to—Automation—Numerical Control" (Paper No. 279), by James C. Keebler, managing editor, *Automation* magazine.

"Areas in Which Automation Is Useful" (Paper No. 280), by William C. Goeckel, sales manager, Snyder Corp.

"A Hole in the Tape Is Worth Two in the Head" (Paper No. 281), by Wallace E. Brainard, chief engineer, Servo Machine Tool Div., Kearney & Trecker Corp.

Chairman: Leo Paul Gajda, chief engineer, Snyder Corp.

Automation—Numerical Control II

2:30 p.m. Crystal Ballroom
Sheraton-Cadillac Hotel

"Field Experiences with Automation" (Paper No. 282), by Robert B. Read, service manager, The Cross Co.

"Numerical Controls—How We Use Them" (Paper No. 283), by Charles E. Chapman, manufacturing engineer, controls, Production Engine Dept., Flight Propulsion Div., General Electric Co.

"What Is the Future of Automation and Numerical Control?" (Paper No. 284), by Carl F. Stugard, vice president and manager, Special Machine Div., Cincinnati Milling and Grinding Machines, Inc.

Chairman: Harry R. Bentley, plant manager, Chrysler Corp.

Automation—Numerical Control III

7:30 p.m. Crystal Ballroom
Sheraton-Cadillac Hotel

Individual conferences will be held with all speakers listed above.

High Energy Forming

9:30 a.m. Founders Room

"Why Form Explosively?" (Paper No. 291), by Dorsie C. Harleman, project engineer, Basic Industry Branch, Manufacturing Methods Div., Wright-Patterson Air Force Base; and A. F. Watts, production design engineer "A", Lockheed Aircraft Corp.

"A Critical Review of High Energy Forming Methods" (Paper No. 292), by William W. Wood, supervisor, Manufacturing Research, Vought Aeronautics Div., Chance Vought Aircraft, Inc.

Chairman: Lloyd C. Briggs, management consultant.

Metal Cutting III

2:45 p.m. Founders Room

"Recent Developments in Ultrahigh-Speed Machining" (Paper No. 255), by Robert L. Vaughn, producibility methods engineer, Lockheed Aircraft Corp.; and Robert T. Krueck, project engineer, AMC Aeronautical Systems Center, Manufacturing Methods Div., Wright-Patterson Air Force Base.

"The Effect of New Developments in Metalworking on the Producibility of High-Temperature Metals" (Paper No. 256), by Richard H. Patchen, production engineer, Fabrication Engineering, Aerojet-General Corp.

Chairman: Charles F. Brigner, Jr., chief engineer, Valenite Metals Division of The Valeron Corp.

Production Programming

7:45 p.m. Founders Room

"A New Approach to Production Control" (Paper No. 295), by F. C. Janke, executive vice president and general manager, Hancock Industries, Inc.

"Built-In Production Programming Saves

Another Conference Coming Up . . .

Technical papers are being sought by the ASTME National Program Committee for presentation at the 1961 Engineering Conference in New York May 22-26.

Proposals for papers will be accepted for consideration until June 15, 1960. Society membership is not a prerequisite. Proposals should contain enough information about the paper to allow intelligent action by the committee—an outline of the paper; author's name, title and affiliation; and author's agreement to abide by the published rules for presentation of papers before a national meeting of ASTME.

Authors whose papers are accepted will be so notified by Aug. 10, 1960.

Money" (Paper No. 296), by Michael Zajac, vice president-engineering, Buhr Machine Tool Co.

Chairman: Wayne M. Edward, manager, Production Engineering, Ford Motor Co.

plant tours for tuesday

Tour #8—8:30 a.m. Ford Motor Co.—Ford Rotunda.

Buses leave from Statler and return to Statler. Limit 100 visitors. The tool and die plant contains 415,000 sq ft of floor space, and is staffed with approximately 1500 journeymen and about 200 apprentices. Ford Rotunda is the largest permanent industrial exhibit building in America.

Tour #9—8:30 a.m. Willow Run Plant, Chevrolet Motor Div., General Motors Corp.

Buses leave from Statler and return to Statler. Limit 100 visitors. Visitors will see a complete new plant, equipped for the assembly of rear-engine automobiles.

Tour #10—1 p.m. Argus Camera Div., Sylvania Corp.

Buses leave from Statler and return to Armory. Limit 100 visitors. One of the few photographic lens grinding, polishing, and centering facilities in the U. S., Argus is located in Ann Arbor. Argus lens grinding and polishing is measured in the millionths of an inch, yet lenses can reach top production rate of 18,000 per day. Tour will also include camera assembly line. Visitors will have a chance to see themselves on Argus' new direct-wire TV camera, which will be set up to illustrate industrial applications of the new system.

Tour #11—1 p.m. Enrico Fermi Atomic Energy Plant.

Buses leave from Statler and return to Armory. Limit 100 visitors. This breeder reactor power plant was built by Power Reactor Development Co. Detroit Edison is building a conventional electric generating section adjacent to the reactor plant and will purchase steam from the PRDC to operate the 150,000-kilowatt turbine generator. Detroit Edison also operates an atomic information center on the site, complete with scale models of the breeder reactor, atomic power plant and fuel elements.

wednesday april 27

Heat and the Tool Engineer
(Cosponsored by the Industrial Heating Equipment Association)

9:30 a.m. Crystal Ballroom

"Controlled Furnace Atmospheres Improve Performance of Cutting Tools and Dies" (Paper No. 297), by Russell Frank Novy, assistant director of research, Lindberg Engineering Co.

"Principle and Characteristics of Salt Bath Furnaces" (Paper No. 298), by Leon B. Rosseau, president, Ajax Electric Co.

Chairman: William E. Benninghoff, president, Industrial Heating Equipment Association, and vice president and general manager, Tocco Div., Ohio Crankshaft Co.

Tracer Control

2 p.m. Founders Room

"Numerical Control Versus Tracer Control of Machine Tools" (Paper No. 285), by Leo M. Cross, West Coast regional sales manager, True-Trace Corp.

"Application of Numerical Controls—Proven in Practice" (Paper No. 286), by Steven C. Clark, Jr., sales engineer specialist, Metalworking Program Control Sales, General Electric Co.

Chairman: Don A. Cargill, president, Cargill Detroit Corp.

New Processes

2:15 p.m. Crystal Ballroom

"Plasma-Arc Speeds Many Metalworking Processes" (Paper No. 288), by James A. Browning, director, Thermal Dynamics Corp.

"Machining and Welding with Electron Beam" (Paper No. 289), by Karl Heinz Steigerwald, manager, Carl Zeiss Electron Beam Dept., and vice president, Electrona, Inc.

Chairman: James H. Challoner, supervisor processing and tool design, Chrysler Corp. of Canada.

Metal Cutting IV

9:15 a.m. Founders Room

"Milling High-Strength Thermal Resistant Alloys" (Paper No. 257), by Norman Zlatin, vice president, Metcut Research Associates, Inc.; and Robert T. Krueck, project engineer, AMC Aeronautical Systems Center, Manufacturing Methods Div., Wright-Patterson Air Force Base.

"Drilling Very High-Strength and Thermal-Resistant Metals" (Paper No. 258), by Ralph G. Kennedy, director of laboratories; Robert Johnson, tool research engineer; Nelson Marrotte, manager of metallurgical research; and Edwin Brezina, manager of new product development, all of The Cleveland Twist Drill Co.

Chairman: Jack Ketchman, manager, Production Services Control Dept., Ford Motor Co.

plant tours for wednesday

Tour #12—8:30 a.m. Burroughs Corp., Plymouth Mfg. & Engrg. Div.

Buses leave from Statler and return to Armory. Limit 100 visitors. Visitors will see unit manufacturing departments, assembly lines, wiring sections, shipping dock, powdered metal department, plastic department and commercial inspection. Plant employs a unit manufacturing theory, whereby subunits are completely built-in individual departments, transported to the assembly line and installed in one operation.

Tour #13—8:30 a.m. Chrysler Corp., Engine Div., Mound Road Plant.

Buses leave from Statler and return to Armory. Limit 100 visitors. The V-8 engine plant occupies 500,000 sq ft of floor area, producing 150 engines per hour and contains automatic equipment found nowhere else in the industry. Outstanding is the assembly line and complete automatic engine testing.

Tour #14—1 p.m. General Motors Technical Center.

Buses leave from Armory and return to Armory and Statler. Limit 100 visitors. Internationally known, the technical center features outstanding examples of modern architecture and the ultimate in equipment. A guide will board each bus to describe the facilities and stops will be made at several of the lobbies to examine exhibits. The entire group will assemble in the Process Development Section auditorium to view a film of the latest developments of interest to tool engineers. Cameras welcomed.

Tour #15—1 p.m. Ford Motor Co., Sterling Plant, Transmission and Chassis Div.

Buses leave from Armory and return to Armory and Statler. Limit 100 visitors. Visitors will see the largest number of gear-cutting machines assembled under one roof, as well as the axle housing tube mill which forms thousands of feet of seamless tubing from coiled sheet steel. A large number of automatic transfer presses, utilizing progressive dies which draw and completely form various components of rear axles and front suspensions, will be seen. Also of interest will be the automated front suspension assembly lines and a multitude of automatic transfer machines.

thursday april 28

Metal Cutting V

9:15 a.m. Founders Room

"Cost Saving Through the Use of Throwaway Tooling" (Paper No. 259), by Joseph W. Heinmiller, general superintendent-production, Chrysler Corp.

"New Developments in Throwaway Boring Tool Application" (Paper No. 260), by William Yogus, chief engineer, The Valeron Corp.

Chairman: Bruce A. Wharram, tool supervisor, Chevrolet Motor Div., Passenger Transmission Plant, General Motors Corp.

Control Valves

9:30 a.m. Crystal Ballroom

"In-Plant Application of Air Controls" (Paper No. 271), by Walter D. Ludwig, president, Mechanical Air Controls.

"Using New Signal Sources for Hydraulic Control Valves" (Paper No. 272), by John J. Pippenger, vice president and chief engineer, Double A Products Co., subsidiary of Brown & Sharpe.

Chairman: Frank L. Mackin, department chairman, Engineering Shops, General Motors Institute.

Metal Cutting VI

2 p.m. Crystal Ballroom

"Milling with Throwaway Inserts" (Paper No. 261), by Anthony S. Rogers, general sales manager, Wesson Co.

"User's Viewpoint on Throwaway Tip Milling Cutters" (Paper No. 262), by Clifford P. Farr, manager of tooling facilities, Massey-Ferguson Ltd.

Chairman: William C. Killen, assistant master mechanic, Pontiac Motor Div., General Motors Corp.

plant tours for thursday

Tour #16—8:30 a.m. Ojibway Salt Mines of Canada. (This is a repeat of Tour #5.)

Tour #17—8:30 a.m. Great Lakes Steel Co., Div. of National Steel Corp.

Buses leave from Statler and return to Armory. Limit 50 visitors. Great Lakes Steel has a plant area of 538 acres with 103 acres under roof, 49 miles of railroad track and a capacity of 3,200,000 tons of steel per year. Visitors will see 50,000-pound ingots reduced to 6-inch slabs, which in turn are hot rolled to a 90-inch-wide sheet.

Got a Problem?

A Product Information Booth will be operated during the Tool Show at the Detroit Artillery Armory, to serve as a center for information on machines, tools, tooling and manufacturing equipment of all kinds.

Staffed by editors of THE TOOL ENGINEER, the booth will give engineers and executives visiting the show an opportunity to hear—person to person—about products that will help them solve specific manufacturing problems in their own plants.

Whenever possible, those with questions will be directed to appropriate exhibits at the Tool Show itself. If no exhibit provides the type of information required, a list of companies making appropriate products will be furnished, along with the names and telephone numbers of local suppliers.

Ladies Activities

Le Rendezvous

Parlors B and C of the Statler Hilton Hotel will serve as a ladies' lounge and headquarters throughout the Conference. It will initially open at 6 pm on Wednesday, April 20.

Ladies may register with their husbands (no charge for ladies) at the Conference register area in the Statler or Sheraton-Cadillac.

Canadian Caper

8:30 am, Friday, April 22

Ride via the Windsor Tunnel under the Detroit River to Leamington, Ont., for a tour of the Heinz Cannery. After luncheon at Windsor's Elmwood Casino, an hour will be devoted to shopping. Up to $10 in purchased merchandise can be brought back to the United States duty free. Proof of citizenship, birth certificate or naturalization papers required. Tickets, $4.50.

Previewing what ASTME visitors and their wives will see during their tour of the Henry Ford Museum in Dearborn—and finding an auto that suits them to a T—are these Society Headquarters workers, Mary Jane Stevens, Sylvia Benesh and Carolyn Emberton. This 1909 Model T Ford was among the first of 15 million which Ford made, with very few changes, up to 1927. It was the first two-pedal model; the brass tank on the side furnished fuel for the gas headlights.

Enchanté

2 pm, Saturday, April 23

Designed by the Ladies Committee as a welcome to all visiting women. An opportunity to get acquainted over the punch bowl and learn more of the activities planned for the remainder of the Conference. Tickets complimentary; sponsored by the Modco Tools Division of the Valeron Corp.

Panorama Americana

10:30 am, Sunday, April 24

Tour of the Henry Ford Museum and Greenfield Village, Dearborn, for men and women. Includes special presentation of history of mass production. One of the greatest collections of Americana in existence. In the Museum are such things as the decorative arts galleries, a street of early American shops, many in operation. In Greenfield Village are over 100 historic structures including the Thomas A. Edison buildings and many more. Transportation and admission charges to both the Museum and Village included in $3.75 ticket.

Futurama

10 am, Monday, April 25

Tour of General Motors Technical Center, limited to 50. Center contains many outstanding examples of modern architecture. Luncheon will be "dutch treat" in the GM cafeteria. Scenic route back to the hotel via the Cranbrook Institute, Shrine of the Little Flower, the Detroit Historical Museum and many others. Tickets, $1.50.

The Forward Look

9 am Tuesday, April 26

Tour limited to 50. Final assembly of Plymouth automobiles in one of the world's most modern manufacturing facilities. Tour includes luncheon and commentary by a Chrysler Corp. executive. Tickets complimentary.

Festival of Fashions

12 Noon, Wednesday, April 27

Luncheon and a showing of the latest spring fashions at Detroit's J. L. Hudson Co. Favors and door prizes to be awarded. Tickets, $3.75.

Detroit Au Revoir

10 am, Thursday, April 28

Goodbye's and a brunch. Tickets complimentary; sponsored by F. Jos. Lamb Co.

A wide angle lens looking over the speaker's shoulder records a study in studiousness at the ASTME On-Campus Conference at the University of Colorado. Here most of the 211 who attended the conference are shown listening to John A. Gerzina, vice president and general manager of the Rocky Mountain Metals Div., International Powder and Metallurgy Co., as he talks on powder metallurgy.

Denver's First Conference Nets $700 for Education

Scores of Denver area tool and manufacturing engineers drove 35 miles over a slippery turnpike on a recent Saturday to spend a full day in the rarefied atmosphere of a college mountain town.

It was Chapter 77's first on-campus conference, held at the University of Colorado in Boulder. And in the words of outgoing Chairman John Nosler, "its unprecedented success shows a definite need for future conferences." The chapter executive committee has already ratified the annual occurrence of the conference, to be held at the major Colorado institutions of higher learning. On a rotating basis, the conference will be held next year at the University of Denver, the following years at Colorado State University and Colorado School of Mines.

Although the registration fees were nominal—below $10 for both nonmembers and members—the chapter netted $700 from this first conference. All of the money has already been turned over to the education committee to use as it sees fit for university scholarships, science fair prizes or other worthy engineering education endeavor. Attendance at the Boulder conference totaled 193 registrants plus 18 guests. Among the audience were 135 nonmembers, attesting to the Denver area's interest in tool and manufacturing engineering—and promising further growth for an already healthy chapter.

In an attempt to insure even greater effectiveness in subsequent conferences, the chapter ran an "evaluation survey" at the end of the Boulder program. Registrants were asked to fill out a questionnaire either on the spot or later at their convenience, in which they rated either poor, fair, good or excellent the program as a whole and the program in its various parts. The participants turned in more than 100 of these questionnaires along with their badges at the end of the day.

Dean C. L. Eckel of the university's College of Engineering welcomed the registrants. Five papers during the day included "Powder Metallurgy" by John A. Gerzina of the Rocky Mountain Metals Div., International Powder Metallurgy Co.; "How Positional Tolerancing Clarifies Design Intent and Reduces Costs" by Edward S. Roth, staff member of the Sandia Corp.; "Hydroforming and Hydrospinning" by Donald Runge of The Cincinnati Milling Machine Co.; "Impact Extrusion" by Bruno Glab of Aluminum International, Coors Porcelain; and "Explosive Forming" by Richard T. Gundlach, director of production, Propellex Chemical Div. of Chromalloy Corp.

Contributing further to the conference's theme, "The Modern Art of Metalforming," was the luncheon speech by Chester L. Phillips, general supervisor of manufacturing research and development, the Martin Co. Phillips, who represents his company in its affiliate membership status with ASTME, graphically described some of the Space Age problems that have arisen in the tool engineering field.

"Properties of the new exotic metals," he said, "have invalidated many of the techniques of fabrication on which engineers have relied. The problems now are similar to those faced 20 years ago by air-frame manufacturers when aluminum first

came into production use—except that now the problems are possibly even more urgent than then."

Phillips described his company's research in the welding of space-age metals. Some of the problems encountered in the fabrication of the Titan missile, he recalled, made him "feel like a mosquito in a nudist camp—a lot to be done, but where to start?" Chemical milling and ultrasonic welding have furnished the solution to many of the new problems. The lesson in it all, Phillips said, is that manufacturing technology must precede new product design.

In his talk on explosive forming techniques, Gundlach added to the conferees' thoughts on welding—he predicted practical explosive welding within a year. The aim in this still experimental technique is to obtain simultaneous partial sintering in the explosive process.

Explosive forming, he said, is not useful in high production but is often the answer to the need for complex shapes, either small or very large. The technique has been used to form parts 15 feet long and up to 8 feet wide, with just one die. Admitting that explosive forming is an art rather than a science so far, Gundlach also declared that it cannot eliminate springback. However, he asserted, technique can control or minimize the phenomenon. Besides its inapplicability to high production and some limitations on thickness of metals that can be processed explosively, Gundlach noted another disadvantage in the technique—danger. Himself the holder of an explosive forming "Purple Heart," he admitted that safety precautions often made mandatory explosive forming in the wide open spaces.

Another highlight of the day for the Denver area engineers was Glab's talk and accompanying movie on how a Colorado firm had profitably pioneered in impact extrusion. In color and in startling slow motion at the climax of the process, the registrants saw an automated production line that turned an ingot of aluminum into a filled and decorated can of beer. Although the process can now only produce about a hundred aluminum cans per minute, as compared with top production of around 450 tin cans by conventional processes, Glab said that plans are well underway to up the aluminum extrusion output to 250 cans per minute. A byproduct of the whole development, by the way, is the enrichment of the younger generation's pocketbook—and store of memories. The company is buying back the aluminum cans as scrap at a penny apiece, Glab said, and so far has been getting a 57 percent return.

President Praises Chapter's Vitality

President Ewing, in his remarks closing the conference, paid tribute to the chapter's vitality. He noted that the membership has risen 50 in the last year, bringing the total to 246. In the national perspective, he declared, the Denver chapter is indeed making a good showing in view of the fact that its membership is only six tenths of one percent of the total Society membership.

Whatever the explanation for the warm reception of the on-campus conference idea on a cold day—and one chapter officer attributed the turnout to the fact that the chapter collected in advance from 170 preregistrants—it is reasonable to assume that no one regretted his attendance.

No one man in this line-up can be charged with the success of Denver chapter's first on-campus conference. They're all guilty. Reading to the right from President Wayne Ewing, who came in from Los Angeles to speak at the conference and give unstinted praise to the way it was run, are: Chapter 77 Chairman John Nosler; Richard Crawford, chapter secretary and member of the education committee; Bud Gossman, program chairman; Arnold Schlicher, education committee; Bob Ratcliff, education committee chairman; Alan Montgomery, Ron Murray and Pete Nightingale, all members of the education committee.

Guest speaker at the chartering of Student Chapter 30 was ASTME First Vice President H. Dale Long. At his left is Chairman Bert Underwood of the sponsoring Windsor chapter, who acted as toastmaster for the February meeting.

the first CANADIAN student chapter chartered

TWO THINGS came into existence Feb. 19, both of which gave Canadians good reason to be proud. The first event was the birth of a prince to Her Majesty, Queen Elizabeth II. The second occurrence—second chronologically, not necessarily in terms of importance—might also be called a birth. For that evening in Windsor the first Canadian student chapter was welcomed into ASTME's international fold.

Naturally, a toast was made to the queen and her new offspring. But the Society's offspring, Western Ontario Institute of Technology, Student Chapter 30, was awarded most of the attention at the chartering held at Windsor's Norton-Palmer Hotel.

Joining the Society at this chartering in order to reap its benefits—benefits clearly outlined by guest speaker and chartering officer ASTME Vice President H. Dale Long—were 22 young men studying for careers in tool and manufacturing engineering at the Institute, which itself is less than two years old.

Before an audience which included representatives from a number of other Canadian chapters, members of the National Education Committee, National Headquarters personnel and civic dignitaries, Long discussed the "Opportunities Unlimited" that await students once they acquire a sound moral and technical training.

Tracing the population growth since the time of Columbus, Long, who is president of Scully-Jones & Co. of Chicago, reminded his audience that opportunity increases along with the population. Through greater communication people the world over know what is going on and what is being produced in other countries. This is where tool and manufacturing engineers come in.

At this point in his talk Long utilized a model depicting the manufacturing scene as it is today featuring a plant, a buyer and several salesmen wearing the colors of their respective nations and competing for the buyers' business. Whether it will be the American salesman who gets the business will depend to a great extent on the ingenuity of tool and manufacturing engineers, Long said.

Problem Is Not Price, But Quality

The problem today, he continued, is not how inexpensive a product is but rather how good it is. People are drawn toward a product because of its value, not its price.

Engineers are working hard to supply this value and dependability. Materials, the things they work with, are gaining most of the attention right now. The production miracles that are being worked with

Holding the student chapter charter he has just received is Gerry Nosotti, chairman of the new group. At his left is Charles M. Jackson, principal of Western Ontario Institute of Technology. At right is Joseph Ord, superintendent of secondary schools in the city of Windsor.

The charter officers of Student Chapter 30 pose following their installation. Serving as officers are (left to right) Richard Pekar, secretary; Douglas Harwood, first vice chairman; Gerry Nosotti, chairman; Henry Gentili, second vice chairman; and Robert Wilkes, treasurer. The Windsor students were the first Society members anywhere to receive membership pins with ASTME on them.

plastics was one example cited by Long. Plastic that is stronger, tougher and more stable is being used in cases where previously only metal was called for. Obsolete is a word being applied to processes and methods that served the purpose for years, that is, until tool and manufacturing engineers decided it was time for a change.

This world of change is what awaits young men like those from Western Ontario Institute of Technology, Long said. When they received their ASTME pins the students took their first big step in preparing for this world. That pin brings with it advantages like monthly chapter meetings, the Society publication THE TOOL ENGINEER, Society-sponsored seminars, conferences and research, Society-published handbooks and manuals and, of course, the annual engineering conference and tool show.

Sponsored by Windsor Senior Chapter

Western Ontario student chapter is able to take advantage of these Society benefits because of the work of the Windsor senior chapter. Early in 1959 the Windsor group offered $500 to the Institute for the purpose of buying books and supplies. A mutual interest stirred between the two groups and soon the executives of the Windsor chapter were talking Society membership with the heads of the school, mainly with Principal Charles M. Jackson. Plans jelled and the result was the recent chartering.

Windsor Chapter Chairman Bert Underwood welcomed those attending the charter meeting. Among those he introduced were Harry Conrad, ASTME executive secretary; Bruce Fairgrieve, national director; Gilbert Seeley, education director; and John W. Greve, editor of THE TOOL ENGINEER.

The real celebrities of the evening, however, were the students themselves. It was learned that, although Windsor was their sponsoring chapter, the students insisted upon making all the arrangements for the banquet and chartering. They didn't miss a detail and the activity ran more than smoothly. Chosen to represent the student chapter on the official level were: Gerry Nosotti, chairman; Doug Harwood, first vice chairman; Henry Gentili, second vice chairman; Bob Wilkes, treasurer; and Richard Pekar, secretary. Wladyslaw Slodkiewitz will act as faculty adviser for the students.

Long summed up his talk by telling the students to appreciate their membership in the Society. It's not easy to become a student chapter of ASTME, he said. Stressing that only the qualified will be eligible for a place in the progressive field of manufacturing, he admitted that certain sacrifices had to be made to fulfill this eligibility. Denying themselves some of the pleasures of free time in order to concentrate on their studies is the hard but necessary sacrifice that students must make, he said. Both the training and the sacrifice pay off in the long run for, as Long said in the start of his speech—the opportunities are unlimited.

Members in the News

The appointment of HOWARD L. ROAT, Saginaw Valley chapter, as works manager has been announced by the AC Spark Plug Div. operations in Milwaukee. Roat joined AC in Flint in 1933 as a machine tool designer following five years with the Buick Motor Div. He was named manufacturing manager in 1956. He is a registered professional engineer in the state of Michigan.

Crouse-Hinds Co. has named AUSTIN D. VANDERBILT, Syracuse chapter, manager of industrial engineering. In his new position Vanderbilt will coordinate the work of several departments, including plant engineering, planning, standards, quality control and safety.

PETER LECKIE-EWING, a member of Pittsburgh chapter who, for many years, served with Landis Machine Co., Atlas Steels, Ltd., and Union Twist Drill Co., and who joined Latrobe Steel Co. last year as a metallurgist, has been appointed assistant to the vice president-technical director.

GORDON B. GUENTHER, Cleveland chapter, who formerly held positions with Thompson Ramo Wooldridge, Inc., and Nuclear Products Group, has joined the staff of Industrial Electronics Rubber Co. as director of engineering. Since its formation in 1958 the company had retained him in a consulting capacity and as a member of the board of directors. In his new position Guenther will have charge of the production of IER's line of miniature precision molded rubber products and will assume responsibility for development of automated presses and production equipment.

A veteran of 22 years with General Electric Co., B. E. STORRS, Detroit chapter, has been appointed service engineer with the east-central district staff of the Metallurgical Products Dept. of GE. Storrs started with the company as a cutting tool specialist, later serving as a marketing application engineering specialist. . . . After an association of 21 years with abrasives in the Detroit area, CARLETON D. COLE has been appointed regional manager of the Detroit office of the Midwest Abrasive Co., Owosso, Mich.

WERNER VOGT, Central Connecticut chapter, has been promoted to chief development engineer in charge of advanced planning for wire and strip forming equipment in the Machine Div. of The Torrington Mfg. Co.

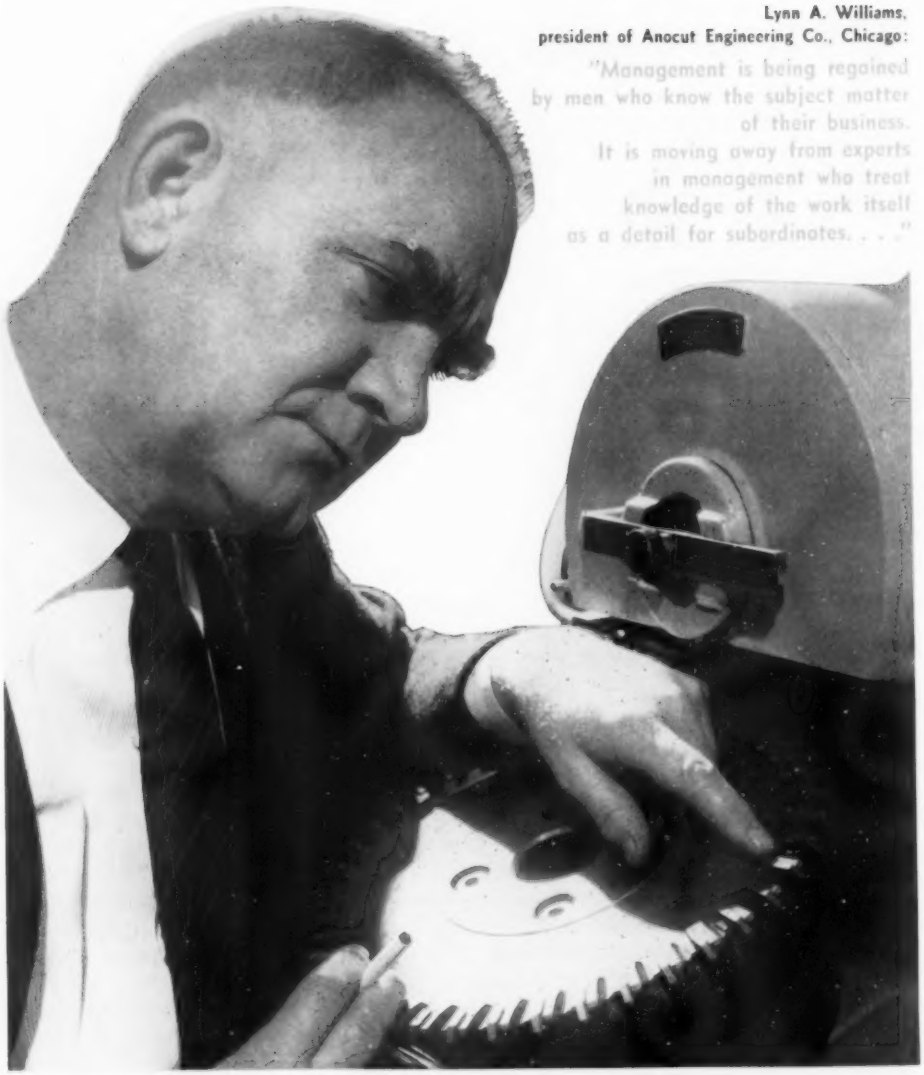
PETER RUSNOV, a native of Cleveland and a member of Cleveland chapter, has been named chief industrial engineer for Warner & Swasey. Rusnov joined the company in 1946 as senior machine designer in the textile division, after having been with United Autographic Register Co. and Cleveland Pneumatic Tool Co. In his new capacity he will direct and coordinate the functions of methods, standards and tool design.

LOUIS POLK of Dayton chapter has been appointed manager of operations of Sheffield's product divisions. His new assignment is in addition to his continuing responsibilities as assistant vice president and manager of the Instruments and Systems Div. and direction of Sheffield's domestic and Canadian service plants.

Membership on the Menu

Ways and means of retaining members was the theme of a recent National Membership Committee meeting. Left to right are Samuel Kuba, Lehigh Valley; John Pridgeon, Grand Rapids; Walter Kiefer, Pittsburgh; Robert Johnson, Twin Cities; Ralph Chrissie, Los Angeles; Chairman Arnold Unruh, North Texas; Glen Underwood, Headquarters staff; David Chambers, Fort Wayne; and Marvin Bunting, Headquarters.

MAN OF ACTION



Lynn A. Williams,
president of Anocut Engineering Co., Chicago:

"Management is being regained by men who know the subject matter of their business. It is moving away from experts in management who treat knowledge of the work itself as a detail for subordinates. . . ."

ASTME PROFILE

A Well-Rounded Tool Engineer

AMERICAN INDUSTRY is seeing a renaissance of the well-rounded man. Lynn A. Williams of Chicago is a striking example.

The energetic, slightly grizzled, slightly gruff industrialist epitomizes a new breed in the Society—the "compleat" tool engineer. At 51, Williams is a thinker and a doer; an executive, a scholar, educator, yachtsman, family man. Perhaps he would be a snob, too, if he weren't such a pessimist.

How could anyone be a pessimist who runs a going business, who has a wife and five optimistic children in an optimistic suburb, who perennially wins the Mackinac yacht race, who is board chairman of the Great Books Foundation, who has a blue-ribbon educational background from North Shore Country Day through Yale and Harvard, with a bit of M.I.T. thrown in for seasoning?

Here is what he said at a meeting of Great Books participants a year ago:

"There have been times in history when the world did not seem so troubled. Perhaps the early part of our century was such a time, when the world seemed orderly and progress all but inevitable. Electric lights were taking the place of the gas burners. New and tall buildings, taller than ever before, were being erected. The Wright brothers were flying their airplane at Kitty Hawk, and then, as now, there were

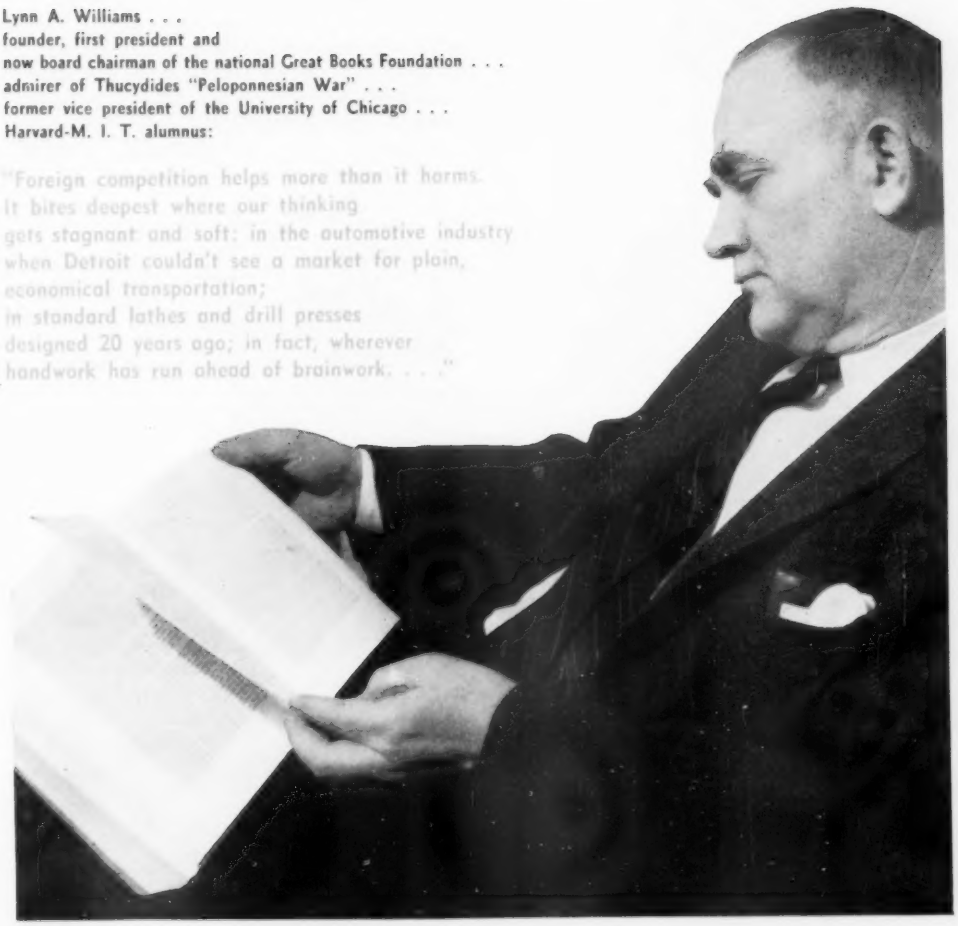
Continued on Page 218

"American metal industries are now more conservative than the European. They are more cautious, slower to change. I think it's caused by success and the complacency and fear of progress that often go with it. American industry feels it has arrived; that is the present danger. . . ."

"Nonproductive labor costs just as much as productive labor, often more. Here is the great forgotten area for cutting costs. Yet many plants have an unwritten rule against spending money for new equipment—like tool-room machinery—if it's called 'nonproductive.' I wonder why. . . ."

Lynn A. Williams . . .
founder, first president and
now board chairman of the national Great Books Foundation . . .
admirer of Thucydides "Peloponnesian War" . . .
former vice president of the University of Chicago . . .
Harvard-M. I. T. alumnus:

"Foreign competition helps more than it harms. It bites deepest where our thinking gets stagnant and soft: in the automotive industry when Detroit couldn't see a market for plain, economical transportation; in standard lathes and drill presses designed 20 years ago; in fact, wherever handwork has run ahead of brainwork. . . ."



AND THOUGHT

predictions that soon the sky would be full of man-driven birds. And the proposal of Dr. Einstein—E equals MC^2—was reported in the newspapers with much jocularity because, so it was said, no one, perhaps not even Dr. Einstein, could understand it. The world was a pleasant place. The darkies were strumming their banjoes and, in the words of that elegant and touching ballad, 'Everything was up to date in Kansas City.'

". . . Today, anyone who expressed as hopeful a view as that which our fathers and grandfathers shared would be either a politician with something to defend, or a fool. I think I do not overstate the matter when I say that we know now quite simply that the world is a mess."

An articulate concern for the state of society and the state of its individuals has been abiding with Williams for years. It took demonstrative form as far back as 1947, when he upset his own apple cart of conventional success.

He quit an affluent job as vice president of Stewart-Warner Corp. because "the thought kept recurring to me that making automobile heaters was fun—but not very important." Exposure to a Great Books course—the famous "fat men's" course in Chicago—had convinced him that such things are part of the end of human life rather than the means.

Admittedly feeling like a hero, but bridling when people assumed he had inherited a large sum of money, he set about making the great books movement nationwide. His Socratic efforts as a latter-day gadfly paid off—if a nonprofit organization can pay off—and he succeeded in getting backing for the Great Books Foundation. He served the foundation as its first president in 1947-48 and is now chairman of its board of directors.

Despite his active obsession with the realities of life as it is and with the possibilities of life as it should be, Williams manages to keep his feet on the ground as an engineer-industrialist.

"A complete tool engineer," he admits wryly, "must indeed be a 'compleat angler' if he is to get anywhere these days."

Williams admits that he is hard put sometimes to measure up to his own standard in his day-to-day work as president of the Anocut Engineering Co., a successful and fast-growing firm situated in the heart of Chicago's machine-tool district. He started the Anocut firm in 1954 as a side line to his practice as a patent attorney. Since then, he has turned more and more of his attention to Anocut's development and commercialization of electrolytic machining for materials which are difficult or costly to handle by older methods. In a recent issue of THE TOOL ENGINEER, Williams told about his company's new development, a plunge-electrode, cavity-sinking machine which utilizes the same electrolytic principle as that previously applied to the rotating-wheel equipment which has already gone into extensive industrial use.

—By M. L. Stone
News Editor

"A man who wants peace and quiet shouldn't be a tool engineer. But too many tool engineers are scared of their jobs, and, as a result, they don't do their jobs very well. The old, shopworn slogans about 'keeping out of trouble' and 'staying away from the boss have ruined more men than they have ever helped. Management also has a duty to develop a relationship with tool engineers which maximizes the talents of both, but a tool engineer has a duty to speak up and to fight for what he knows is needed. Some so-called tool engineers won't believe a job can be done until they see it running. These men aren't engineers at all. The essence of good engineering is to have the ability to analyze and, then, to have the willingness—and the guts—to act on the analysis. The man who won't analyze or who won't act will see other men pass him by."

chapter news

HARTFORD—Retiring Chairman Paul Pick (second from right) tours the heat-treating department of the Allen Mfg. Co. with Chapter 7's new officers. Examining parts as they come from one of the continuous belt-controlled atmosphere furnaces are (left to right) Joe Page, first vice chairman; Howard Wheeler, chairman; Cass Olderman, secretary; Doug Proctor, second vice chairman; Pick; and Jim Savery, treasurer. Some 175 Hartford members and guests took the tour. ***—G. S. Haviland***

Framingham Chapter Chartered By Ewing; Eighth in Bay State

FRAMINGHAM, Mass.—Massachusetts, leader in electronic miracles of today and tomorrow, now boasts another Society chapter—the first to be chartered since the addition to the name of the Society, and the eighth in the Bay State. Chapter 163, Framingham, was officially launched during ceremonies at the Monticello Restaurant in Framingham on Feb. 1. ASTME President Wayne Ewing officiated.

Officers of the 85-member chapter include Chairman John E. Rotchford, former chairman of the National Standards Committee; Seymore Benedetto, first vice chairman; Walter A. Renfroe, second vice chairman; John J. Paulino, secretary; and Les Horne, treasurer.

In addition to Framingham, ASTME chapters in the state include Boston, Merrimack Valley, Springfield, Worcester, Northern Massachusetts, Southeastern Massachusetts and North Shore.

Kansas City Seminar Scheduled for April

KANSAS CITY—An all-day seminar on "Numerical Control Machining" has been planned by Chapter 57 for this April 29. It will consist of an afternoon and evening session running from 1 to 9 pm.

Topics and speakers for the afternoon session will be: "What Is Numerical Control?" J. L. Burg, vice president of Burg Tool Co.; "Designing Machines for Controlled Systems Machining," H. M. Fuldner, superintendent of Servo System engineering at The Cincinnati Milling Machine Co.; and "Meeting Production Schedule with Numerical Control," N. P. Sikich, associate and application engineer at Kearney & Trecker Corp.

After dinner at 6 pm, two more topics and speakers will be featured. They are: "Factors To Consider in Programming for Numerical Control," J. R. Ballinger, engineering manager at Bendix Industrial Controls, Bendix Aviation Corp; and "Numerical Control Application," Keith Alexander, senior tool engineer at Boeing Aircraft.

Following the speakers there will be a question and answer session with further discussion of the specific topics. *—Vern Scott*

DETROIT—Joseph F. Wrobel (left), the new chairman of the chapter that will host the 28th Annual Engineering Conference and Exhibit at Detroit from April 21 to 28, gets a congratulatory handshake from outgoing Chairman Ben Wallis. Other new officers are Joseph J. Gabrick, Edward Till and Eugene Makie, vice chairmen; Harry Lienau, secretary, and Ken Jenks, treasurer. ***—C. Francis Wrobel***

Worth of Investment Castings Discussed At Indianapolis

INDIANAPOLIS—The realistic appraisal of the investment castings process, covering not only the advantages but the limitations too, was the topic covered by W. O. Sweeny, vice president of Arwood Precision Castings Corp. He spoke at the February meeting before an audience of 135 Chapter 37 members and guests.

Investment castings are more expensive than die castings or metal stampings, he began. But they are also far superior to any other means when it comes to parts made of high alloys and/or intricate shapes. The first investment castings could be held in the palm of the hand, but today it is not unusual for one to weigh 100 lb or more.

Sweeny showed that in a case where a part has to be die cast and the certainty of the design has not been decided, it is more economical to produce the prototypes by the investment castings process. It is simple to change the pattern and recast the part with the new design without too much expense. He explained how a large company had 17 changes on a part before the design was frozen. If they had started with die castings, the cost of the changes would have been exorbitant.

The tolerance on investment castings is generally 0.005 inch per inch. In some cases, Sweeny said, the part can be designed so the tolerance will be less. In one instance where a customer wanted a distance of 5.000 held to 0.002 tolerance between two holes, it was necessary to build up two lugs, one by each hole, to prevent shrinkage.

Sweeny summed up by saying that their limitations in respect to tolerances are far outweighed by the advantages of using investment castings for parts made of high alloys and intricate shapes. *—Robert R. Huser*

ROCKFORD, Ill.—Chapter 12 recently feted its past chairmen. Here, listening to speaker Kay W. Ross, personnel director of the National Cash Register Co., elaborate further after his talk on "Human Relations in American Industry and Business," are (left to right) Edward W. Dickett, the chapter's founder and first chairman; Marshall E. Samuelson, immediate past chairman; and Ernest A. Norrman, present chairman. *—Ray O. Brown*

Oregon State Students Publicize the Society

CORVALLIS, Ore.—Student Chapter 19 of Oregon State College recently presented a display at the annual Engineers Ball on the campus. The theme of the exhibit was "Tooling for Tomorrow."

R. W. VanBuskirk, chairman of the display, called upon industry to obtain articles to be used in the display. The student members exhibited many pictures of tooling used by the Boeing Airplane Co. in its missile production. Pressure valves loaned to the chapter by the U. S. Bureau of Mines Research Center in Albany, Ore., were used to show applications of titanium. In addition, the display contained material describing ASTME, its purposes and scope on the campus.

—Dee J. Hillberry

Dynamic Automation Subject at Ithaca

ITHACA—At the January meeting of the Ithaca chapter, 75 members heard Roy Higgins, engineer in the special equipment department at IBM, Endicott, enumerate the advantages of tape-controlled manufacturing. Among those he listed were: less fatigue on the part of the worker, greater competition with firms here and abroad, faster production, better quality, safer operations, and lower costs.

Higgins described the operation of a tape-control system used for milling and jig boring operations. The unit is conveniently located adjacent to the machine. It then feeds data to the machine, guiding the cutter to the parts to be profiled. It can be arranged so that parts are automatically fed from presses. Parts to be drilled, tapped and bored, as well as contoured, may be preformed to save time transforming to other machines.

The other illustration shown by Higgins was a jig bore machine using tape-control automation. Jig bore machines are used for cutting ultraprecision holes in plates and castings. Among the operations controlled by the punched tape are positioning, boring, feed-speed setting, tool changes and depth of bored holes held within 0.002 inch. An exact schedule can be planned with tape programming.

Complete automation systems, Higgins said, can be used to many advantages right from sales to shipping.

—Anna B. Gage

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Greenville-Spartanburg Chapter 164 Chartered By National President

GREENVILLE, S.C.—President Wayne Ewing presented the Society's 164th charter to Greenville-Spartanburg Chapter 164 in ceremonies at Greenville, S. C., on Feb. 26. The 81 charter members of the new group are all transfers from Piedmont, the sponsoring chapter in North Carolina.

The Greenville-Spartanburg chapter had been operating as a subchapter of Piedmont for some time prior to its official launching, with A. Clayton Brown of the Draper Corp. as its chairman. Brown was installed as permanent chairman. Other officers are: Edward V. Stanek, Steel Heddle Mfg. Co., Greenville, first vice chairman; Warren L. Septon, Home Lite Corp., Greer, second vice chairman; R. Harold Hand, Jr., Saco Lowell Shops, Greenville, secretary; and Lewis A. Ward, Jr., also of Saco Lowell, treasurer.

Main speaker of the evening was the state's lieutenant governor, Burnett R. Maybank. Spartanburg Mayor Neville Hokum also spoke, and Dr. John McCormack, a Society member and a professor of metallurgy at nearby Clemson College, acted as toastmaster.

Some 200 members and guests attended the ceremonies. Among them were Ralph Burton, who drove all the way from Bristol, Tenn., where he is chairman of another fledgling ASTME chapter; and Ed M. Ketchie, area captain of the National Membership Committee, who was instrumental in the organization of the new South Carolina chapter.

Harmon Shaw, incoming chairman of Piedmont chapter, noted as he presented a $100 check to Chapter 164 that its sponsorship by Chapter 82 led him to "expect twice as much out of this new chapter."

Represented among the membership besides Clemson College, are area industries such as Saco Lowell, Robotype Corp., Plastic Bilt Co., Draper, Homelite Div. of Textron, General Electric and American Emery Wheel Works.

Assisting Ewing in the charter presentation was John Groomes, administrative assistant to the ASTME executive secretary.

Grand River Valley

"Effects of the Major Factors in the Grinding Process" was the topic of a talk by John A. Mueller, manager of the grinding laboratory at the Bonded Abrasives Div. of The Carborundum Co. Mueller spoke at the February meeting of Chapter 81.

OKLAHOMA CITY—Pausing during the February plant tour of the Southwest Electric Co. are Chapter 125's new officers. Left to right are DeForest Hearn, secretary; Howard Robinson, first vice chairman; James White, chairman; Keith Purcell, treasurer, and James Dunn, second vice chairman. *—Lee Roy Chapman*

LONG BEACH—When Chapter 84 hosted the recent meeting of the California Council of Chapters, the 70 delegates split up into working groups. One of the groups was this editorial subcommittee: left to right around the tables, Paul J. Bodnar, of the host chapter; George Tilden, Los Angeles; Lou Velia, Riverside; Ken Allen, San Gabriel Valley; James H. Medford, Long Beach, member of the National Editorial Committee; R. G. Crouch, Santa Ana; and John Bethune, San Fernando Valley. *—Paul J. Bodnar*

SANTA CLARA VALLEY—At a meeting which featured James Meehan of Brown & Sharpe as guest speaker, the new chapter officers were also elected. They are (left to right) Al Durston, treasurer; Lloyd Marks, secretary; Russ Meredith, third vice chairman; Rudy Komuchar, second vice chairman; Dresden Smith, first vice chairman; and John Groves, chairman. *—W. C. Lanyon*

Detroit Visitors, Please Note!

ASTME Headquarters recently mailed out the official program of the 1960 Engineering Conference and Exhibit, urging Society members to come one and come all to the Detroit show. The only trouble is, nothing in the "Tooling for Productivity" booklet reminded the members that—eventually—they should go back home.

Specifically, the booklet contained a hotel reservation form which included a line for arrival date but failed to include a line for *departure date*.

No reservations can be assured unless the departure date is indicated.

Low Volume Production Theme of Conference

CEDAR RAPIDS—Chapter 71 will stage its sixth annual campus conference April 9 at the University of Iowa, Iowa City.

The conference on "Low Volume Production" will feature seven speakers. In addition to the technical sessions, a program has been scheduled that should attract registrants' wives and also children of high school age

—Roy T. Sadler

Quality Control Outlined at Piedmont

PIEDMONT—Quite a complex subject, "Variables in Manufacturing and Utilization of Statistical Controls," was developed by the guest speaker at Chapter 82's January meeting. Addressing the 149 persons present was Charles O. Wright, senior engineer of statistical quality control at Western Electric Co., Inc., Winston-Salem, N. C.

Wright demonstrated that statistical quality control is usable and valuable in almost any manufacturing situation. He traced the industrial revolution from the time of the craftsmen guilds through present-day mass production controlled by the application of go and not-go tolerances. The speaker also outlined the development of X, R and P charts.

Wright said that the statistical quality control concept was derived from the proper application of the law of large numbers. As a practical demonstration, he used a quincunx to illustrate this law. The quincunx is a device which drops steel balls through a pyramid of equally spaced pins into one of a number of equally spaced slots. *—J. F. Lucas*

WORCESTER—Israel Weisman (center) comptroller of Lodding Engineering Corp., discussed profit sharing and how it can increase production at the January meeting. He is pictured here with Roger Erickson (left) Chapter 25 editorial chairman, and Robert Morrow, chairman of that chapter. *—Roger H. Erickson*

New Chapter Officers Named for 1960-61 Term

CINCINNATI: Frank Houston, chairman; Frank Kutz, first vice chairman; Joseph Williamson, second vice chairman; Val Anzalon, secretary; Norman Ahlgrim, treasurer.

MANSFIELD: Floyd Wrasse, chairman; William Brendemuhl, first vice chairman; Eugene Funston, second vice chairman; Clarence Lucius, third vice chairman; Jack Hamilton, secretary; Marion Easterday, treasurer.

ITHACA: Don Gibson, chairman; Roger Geer, first vice chairman; Don Wilcox, second vice chairman; Charles Cody, third vice chairman; Roy Munson, secretary; Peter Doll, treasurer.

CANTON: John C. Richey, chairman; Wilbur Espenshied, first vice chairman; Jack E. Miller, second vice; T. J. Esway, secretary; L. E. Lewers, treasurer.

SYRACUSE: Robert K. Metz, chairman; Harold McNair, first vice chairman; Robert Eaton, second vice; Leo Turk, third vice; Nicholas Verish, secretary; Lawrence Minor, treasurer.

SPECIAL EVENTS

On-Campus Conference "Numerical Control In Manufacturing"	Mar. 31, '60	Lehigh University Bethlehem, Pa.
6th Annual On-Campus Conference "Low-Volume Production"	Apr. 9, '60	University of Iowa Iowa City, Iowa
ASTME 28th Annual Meeting and Engineering Conference	Apr. 21-28, '60	Statler Hilton and Sheraton-Cadillac Hotels Detroit, Mich.
ASTME Tool Show	Apr. 21-28, '60	Detroit Artillery Armory Detroit, Mich.
8th Annual On-Campus Conference "Scientific Applications for Tool and Manufacturing Engineers"	May 14, '60	Purdue University Lafayette, Ind.
ASTME Western Tool Show	Nov. 14-18, '60	Memorial Sports Arena Los Angeles, Calif.

Saginaw Valley Plans Manufacturing Show On New Flint Campus

SAGINAW VALLEY—The second annual Manufacturing Exhibition will be presented May 16-18 in the Ballenger Field House on the new college campus in Flint, Mich.

Cosponsoring the exhibition with the Saginaw Valley ASTME chapter are the Flint Board of Education, the Flint Junior College and the Mott Foundation. The exhibition is open only to manufacturers located in Saginaw Valley area, which is one of the richest sources for manufactured goods in the nation. The exhibit is a nonprofit undertaking designed to foster better understanding among industries and their neighbors in the valley. *—A. P. Lind*

Society Pioneer Dies

DETROIT—Harry Pelphrey, director of research for the Michigan Tool Co. and an organizer of the Society, died Feb. 18 at age 57. Regarded as one of the industry's leading research engineers on gears and gear manufacturing, Pelphrey had been with Michigan Tool since 1929 and previous to that had spent a decade with the Ford Motor Co. He is survived by his wife Lillian and two brothers.

Elections and Panel Highlight Meeting

NIAGARA DISTRICT—Donald S. Wood, executive vice president and manager of the Automotive Parts Manufacturers Association, spoke to the Chapter 65 membership on the methods, practicability and types of die casting.

A film entitled "The Shortest Way" and a panel discussion conducted by five die-casting experts followed Wood's talk. Staffing the panel were M. H. Weatherhead, assistant manager of Precision Castings, Ltd.; W. Clarke, manager of Barber Die Casting Co., Ltd.; F. B. Pillman, sales manager at Canadian Steel Improvement, Ltd.; Harvey McNevin, general manager of Last Minute Mfg. Co.; and W. T. Watson, assistant plant engineer at Aluminum Co. of Canada, Ltd. To illustrate the discussion a display of the different types of die castings was employed.

The annual election of officers was also held at this meeting. Accepting the chapter's official positions were S. Reif, chairman; J. Markus, first vice chairman; B. Reimer, second vice chairman; N. Erdie, secretary; and John Dewar, treasurer. *—G. Cant*

Committee chairmen for the Saginaw Valley Manufacturing Exhibition are (left to right) Chapter 68 Chairman Frank D. Faga, finance; First Vice Chairman James L. Elliott, activities; and Chapter Secretary Michael Skunda, general chairman of the exhibition.

Grinding Techniques Seen By Ann Arbor Members

ANN ARBOR AREA—Forty-five members of Chapter 79 toured the Sundstrand-American Broach Div. plant of the Sundstrand Corp. recently, viewing the company's abrasive belt grinders performing operations on piece parts of ferrous and nonferrous metals and various plastics. Later, at the company's methods rooms in the Ann Arbor plant, they saw centerless, surface and contour grinding that would not be attempted on hard grinding wheels, ranging from offhand snagging of forgings to precision flatness grinding of printed circuit boards.

The engineers also were shown a 62-inch-wide grinder, specially designed to grind 5x8-foot sheets of laminated plastic. Before the plant tours, they heard a technical lecture on grinding by Marty Sattleburger, director of methods of the Sundstrand Engleberg department. *—Frederick L. Fitts*

CENTRAL CONNECTICUT—L. A. Hauser, metallurgist at Universal Cyclops Steel Corp., spoke at the February meeting of Chapter 148. At this same meeting the new slate of officers was submitted by the nominating committee and accepted by the membership. *—Arthur C. Neil*

Positions Available

LEADING MANUFACTURER OF TUNGSTEN CARBIDE products has growth opportunity for outstanding salesman with knowledge of metal-working field. Call on distributors and large accounts in Dayton, Cincinnati, Columbus and Indianapolis area. Service engineering help available. Must be able to produce without close supervision. Good salary, plus commission, plus profit-sharing-retirement plan. Mail resumé to sales manager, Adamas Carbide Corp., Kenilworth, N. J.

SALES SERVICE ENGINEER—for application engineering on Ferro-Tic, the new steel-bonded machinable carbide. Work with distributors and industrial customers. Ground-floor position, advancement. Extensive travel. Salary commensurate with experience. Sintercast Div. of Chromalloy Corp., Yonkers, N. Y.

MANUFACTURERS AGENTS — Diamond Wheel manufacturer requires active and progressive representation; several choice territories available. Products include resinoid and metal bonded wheels, also wheels for electrolytic grinding. All products fully guaranteed. Write Diacraft, Inc., 26538 West Seven Mile Rd., Detroit 40, Mich.

Design Problems Heard at Keystone

KEYSTONE—If a person unacquainted with the process were to visit the Western Electric plant at Allentown, Pa., and observe a female operator at one of the specially designed machines, he might think he was watching the invisible clothing of Aesop's fables being woven. But no such mistake could be made by the members of Chapter 101 after they heard E. W. Nelson, chief of machine and tool design in the engineering department at Western Electric. They had a chance to hear Nelson at their January meeting.

Nelson told the ASTME audience of the major manufacturing problems that arise in the winding of a 0.0003-inch-diameter tungsten wire to a 0.010 ± 0.0004-inch pitch with an exponential varying pitch on each end of a coil. The coil, the speaker said, is required for a traveling wave tube often utilized in a radio relay type of transmission.

Another innovation in setting up this machine was a special accuracy screw with a geared-driven nut to effect a 0.010 pitch. Nelson also spoke of a timing device that had to be designed. It actuates a cam that gives the exponential variation at each end of the coil. The coil diameter is held to ± 0.0002. *—W. F. Brennan*

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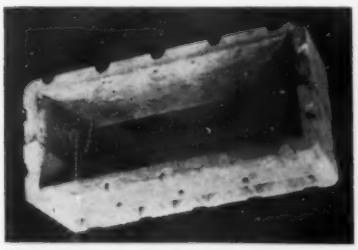
MOLDED FIBERGLASS INSULATION PROVES SHOCK RESISTANT

Fitted exactly to the contour of an electronic chassis, molded fiberglass provides lightweight thermal insulation. This insulation, manufactured by Fibrous Glass Products, Inc., is used on chassis designed for missile use. It is custom-molded for a maximum use of



Resin-bonded fiberglass provides for maximum use of cooling air while maintaining low weight.

cooling air while keeping over-all weight very low.

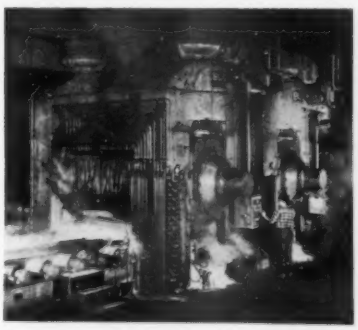
In the design of this part only two sections perform the insulating job previously done less efficiently by many small pieces of insulation pasted to the metal. With fewer parts, maintenance is simplified and damage during assembly is minimized. An additional benefit of this design is an increase in the shock resistance of the entire chassis due to the cushioning characteristic of fiberglass.

ROLLING MILLS INCREASE ALUMINUM PRODUCTION

Four hot and cold reduction mills at Olin Mathieson Chemical Corp.'s new Omal, Ohio plant are able to produce 10 million pounds of flat aluminum products a month. Gages range from slab and plate down to 0.006-inch strip in widths up to 66 inches. Plate widths can go to 90 inches.

Rolling cycle at Omal begins with 10,000-lb aluminum ingots ranging up to 16 inches in thickness. A series of passes in the reversing hot mill reduces these to ½ inch or less. Width of the slab is controlled by a vertical edger. The plate produced moves down a run-out table to an upcut shear where ends are trimmed. If it is to undergo further rolling, it continues along a 354-ft powered roller table to a second shear and a side trimmer, then to a tandem hot mill, where the hot finish rolling is accomplished.

As material is delivered from this mill, its edges are automatically trimmed and it is coiled on a tension reel equipped with a horizontal belt wrapper. This coiling arrangement for



Rolling mill for aluminum strip production. Mill is equipped with side trimmer, horizontal belt wrapper, scrap conveyor and scrap chopper.

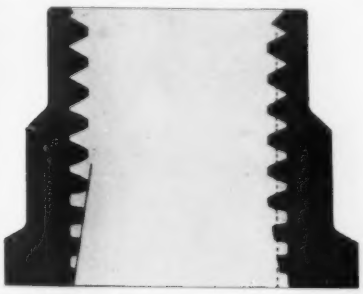
a hot mill is made practical by the relatively low temperatures used in the hot rolling of aluminum.

The coils of hot rolled aluminum strip are then transferred to the tandem cold mill. Strip arriving at this mill ranges in gage from 0.140 to 0.250 inch, and can be rolled to 0.012 inch finished thickness in several passes from the second stand. The mill can roll widths up to 66 inches and the dual uncoiling equipment, which includes a bridle unit and a coil box for the heavier gages as well as mandrel type payoff reel and tension reel with horizontal belt wrapper for the lighter gages, can handle 10,000-lb coils.

REDESIGNED THREAD DOUBLES FASTENER LIFE

Fatigue failure of fasteners, always a serious consideration in industrial and aircraft applications, can be greatly reduced by modifying conventional threads. Research conducted in this field by Elastic Stop Nut Corp. of America has proven that the greatest share of the load in a nut-bolt combination is carried by the first three threads. As a result, design efforts have been directed toward a more even distribution of stress.

No changes in basic thread design have occurred and standard gages and inspection devices are still applicable. Redesign involves only the first three threads which are shortened considerably by countersinking. In this way they still bear a portion of the load but stress is evenly distributed to all threads.



Redesigned thread with special small angle bottom countersink.

An immediate result of the redesigned thread is an entire new family of self-locking nuts with endurance life up to four and one-half times that of conventional thread fasteners. More significantly none of the redesigned fasteners showed less than double the life of the conventional fasteners.

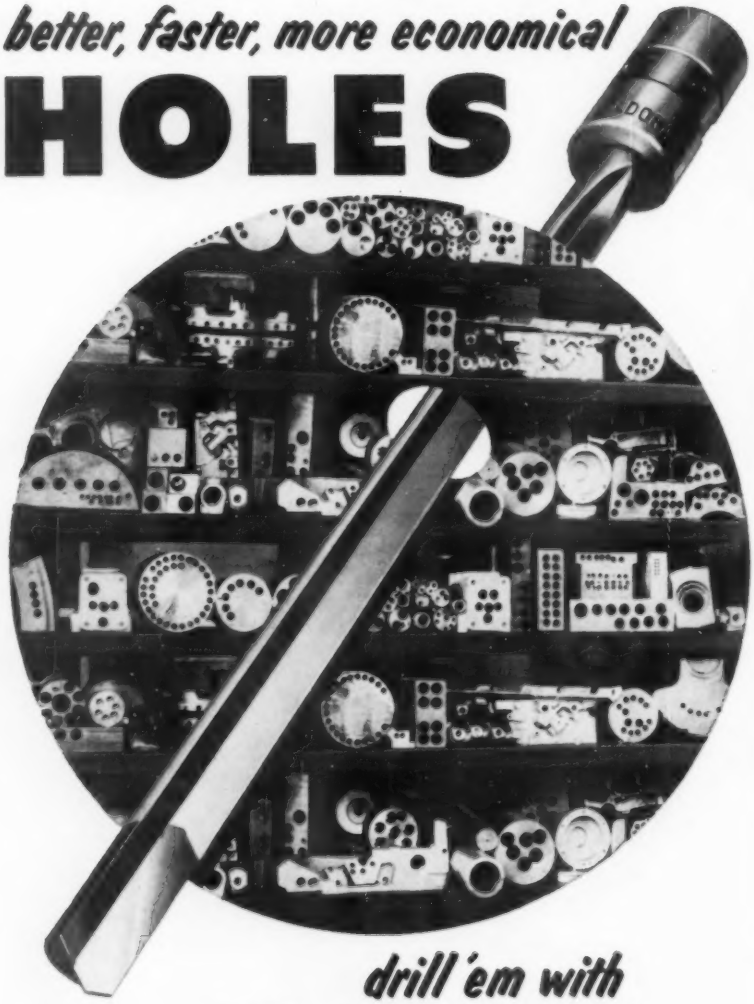
ALUMINUM FERRULES SHOW SUPERIOR CLAMPING ABILITY

Aluminum ferrules weighing just a few ounces are playing a key role in lifting objects weighing many tons. The ferrules are used to clamp together loops of heavy wire rope for lifting machinery, crates, raw materials and even freight cars.

Already in use by several major wire rope manufacturers, the ferrules are special extrusions produced by Reynolds Metals Co. in eight standard shapes and sizes. Their advantage over

better, faster, more economical

HOLES



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Sizes	.1250" to 2" dia.	⅛" to ½" dia. in 64ths	½" to ¼" dia. in 32nds
OA Lengths	4" to 120" with dia. limits	10", 16", 22", 36"	16", 22", 36"
Drivers	Std. or to fit your need	.750" dia. x 2¾" long	1" dia. x 2¾" long
Tips	Carbide	Carbide	Carbide
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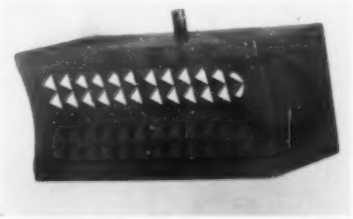
steel clamps lies in the greater ductility of aluminum. This permits application of tremendous pressures to obtain a tighter, unyielding grip without the use of heat. Under pressure, the aluminum flows into all the minute spaces between strands of the wire rope, locking the loop tightly. The aluminum ferrules also are rust free, corrosion resistant, and watertight. They are more economical to apply because they can be formed cold.

CARBIDE INSERTS IMPROVE GRIPPING SURFACES

Holding and feeding mechanisms for metal parts and materials in machining and other processing operations have been improved in performance, and have effected substantial cost savings through use of tungsten carbide gripping inserts. The experience of a number of shops has shown that lower costs have resulted from the elimination of grip wear and slippage which has been costly by way of defective parts, lost time and excessive tool maintenance.

The application of tungsten carbide in gripping surfaces has followed the practice of mounting small tips or inserts in steel holding members as in the Kennametal insert illustrated. Mounting is usually accomplished by brazing in shallow pockets or recesses, but such means as clamps, dovetails, pins, screws and wedges can be used also. In some instances where continuous, positive-



Inserted carbide gripper. Wear resistance of carbide makes it ideal for gripping applications.

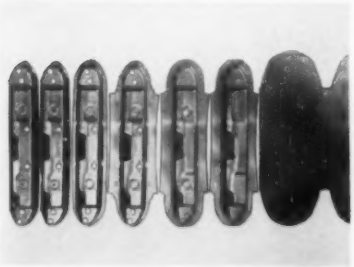
feed is required, small rings have been mounted like tires on little drive wheels. In whatever form these gripping surfaces are made, they have either hobnail or serrated surfaces that can bite into the hardest of steels, steel scale, or other metals without the rapid wear that occurs when the difference in the hardness between the two materials is small.

TRANSFER OPERATIONS PERFORMED AUTOMATICALLY

Coils of steel are transformed into automobile speedometer housings auto-

matically at a rate of 1200 per hour in a new press recently installed at Stewart-Warner Corp., Chicago. The press is a 300-ton capacity Verson Transmat. From coil stock fed into one side of the press to the finished part emerging at the other side, seven operations are performed automatically.

The operations are as follows: notch coil; cutoff and draw; restrike; trim ends, pierce and notch; trim sides and notch; wipe flange and pierce; cam pierce. The Verson press has slide and bolster areas of 54 x 108 inches and has nine die stations, two of which are not



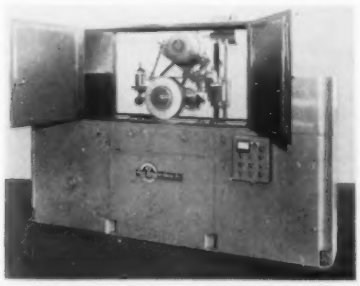
Sequence of operations performed in manufacture of speedometer housings.

used for this job. The slide has a 16-inch stroke and operates at 15 to 30 strokes per minute.

In the press, parts in process are transferred from one die station to another by mechanical fingers. The feed is mechanically actuated and protected against overload by slip clutches on the power take-off shaft and on the feed bar finger racks. The coil feed consists of a rack and pinion roll feed, straightening machine and stock reel.

TESTING MACHINE EVALUATES METAL FINISHING QUALITIES

A new finishing process testing machine designed to enable manufacturers of buffs, compounds and base metals as well as metalworking finishing plants and departments to study and evaluate



Testing machine is adjustable to all variables found in surface finishing.

finishing process variables has been developed by Acme Manufacturing Company, 1400 E. Nine Mile Road, Detroit 20, Mich. The new machine is a production model of an experimental prototype that was delivered to the American Electroplaters Society in 1957 for use in their finishing research programs.

There are several variables that have to be considered in attaining a desired finish quality. Among these are the buffing wheel, the compound, the character of the base metal. Other variables in the finishing process are pressure and time. All these variables affect results.

The Acme testing machine has been developed to permit study of all of these variables so that finishing processes and requirements can be more accurately specified and evaluated for the suppliers of metals, equipment and tooling items as well as for the plant finishing department itself.

The testing machine consists of a cabinet base that houses the mechanism for moving sample materials and a standard adjustable lathe on which the buffing wheel is mounted. The part samples are mounted by toggle clamps or mag-

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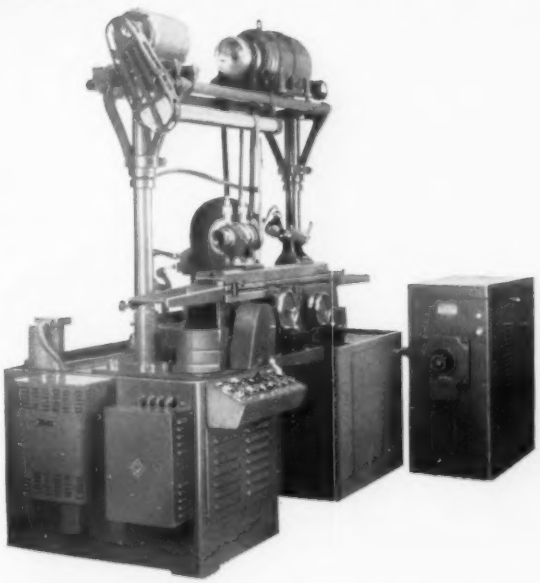
See you at ASTE Show

BOOTH 361



A CRYSTAL LAKE GRINDER will hold size as well as grind round from .000005" to .000020" and finish from One to Four Microinch SURFACE FINISH. The essentials in grinding are a round spindle, taper bearings, a spindle that can be adjusted periodically without the squashing of bronze boxes and to have belt pressure ninety degrees from grinding pressure so the bronze boxes will not wear out of round.

EASY OPERATION: CLOSE TOLERANCES: ACCURACY: FINE MICROINCH SURFACE FINISH:

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netic means on 5-inch by 12-inch platens spaced 40 inches apart on an over-and-under conveyor arrangement. As each platen passes under the buffing wheel, the wheel pressure is accurately measured by a beam scale. The conveyor is driven by a motor through a variable speed drive that provides traverse speeds of from 10 to 30 feet per minute.

Buffing wheel speeds are adjustable from 700 to 2100 rpm. Wheels from 6 to 20 inch diameter can be mounted on the lathe spindle which can be of a stroking type if desired. Wheel pressure of up to 50 lb can be preset by a spring or air cylinder wheel loading arrangement.

Exhaust fans at each side of the rear of the base cabinet keep the finishing area of the machine free of buffing dust. The amount of horsepower drawn by the motor driving the buffing wheel is indicated by an instrument on the front of the machine.

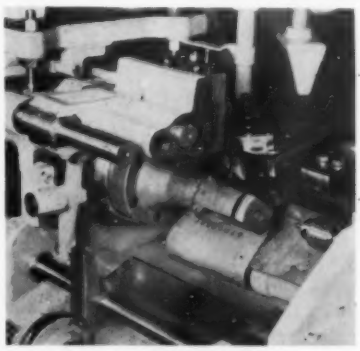
With this machine it is possible to have the following conditions varied for tests: sample feed, buffing pressure and buffing wheel speed. Readings of motor horsepower plus a study of the resulting finish provide a means of evaluating the variables in process speeds and pressures as well as differences in wheels and compounds.

The machine can provide an excellent method of evaluating the finishing qualities of different materials by subjecting each of them to the same set of process conditions. A variety of testing machine arrangements can be built to suit specific requirements.

SPECIAL TOOLING REDUCES LATHE CYCLE TIME

Special tooling adapted to a single-spindle lathe is enabling an automotive concern to perform five operations within a single machine cycle. The tooling, adapted to a Seneca Falls Model "LR" automatic lathe, enables the machine to simultaneously bore, face, chamfer and turn a piston skirt while centering the closed end.

An air-operated centering arbor, fitted with a spring-loaded centering



Special tooling for single spindle lathe. All operations are performed simultaneously.

plate, centers the piston from the bottom of the bore, while three air-operated jaws center the open end. The piston is held against the centering plate by action of an air-operated pull bar and a pin introduced through the gudgeon pin hole. When the piston has been clamped in position, boring, turning and facing of the open end of the skirt is accomplished with tooling mounted on the overhead slide. Simultaneously a chamfer is made using a 45 deg squaring attachment, mounted on the rear of the lathe. All tools operate simultaneously and a high hourly production is obtained, the operation being entirely automatic with operator functions limited to loading and unloading the parts.

SUBMINIATURE MODULES STANDARDIZED FOR PRINTED CIRCUITS

Development of a subminiature line of environmentally tested electronic components designed for printed circuit cards has been announced by Electronic Components Division, Telecomputing

MANEX OPTICAL JIG BORER

2 MACHINES IN ONE

AND

JIG GRINDER (OPTIONAL)

$7885.00 F.O.B. Docks N.Y.

All Castings are made of Meehanite
All Gears are Hardened and Ground

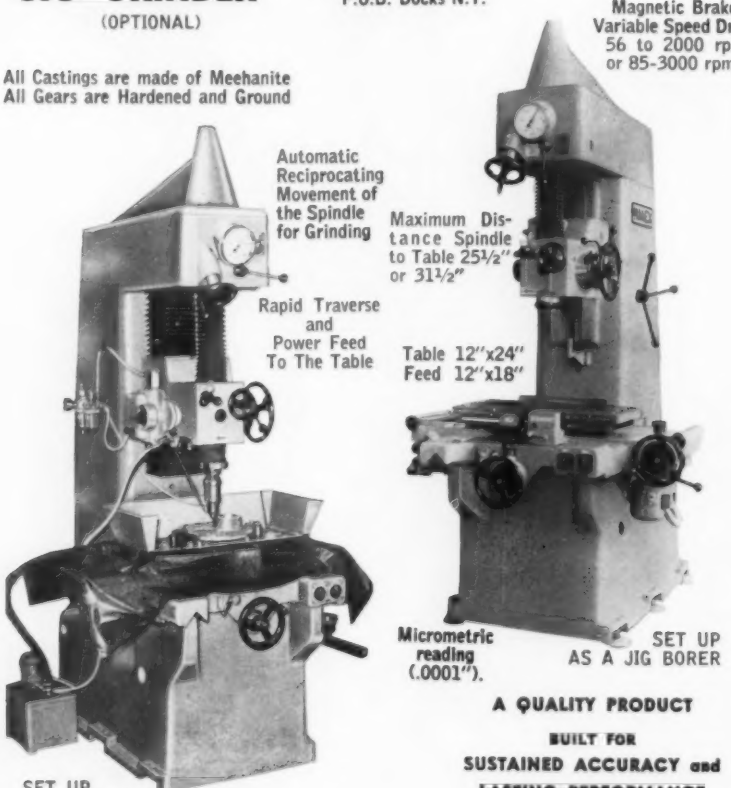
Magnetic Brake
Variable Speed Drive
56 to 2000 rpm
or 85-3000 rpm

Automatic Reciprocating Movement of the Spindle for Grinding

Maximum Distance Spindle to Table 25½" or 31½"

Rapid Traverse and Power Feed To The Table

Table 12"x24"
Feed 12"x18"



Micrometric reading (.0001").

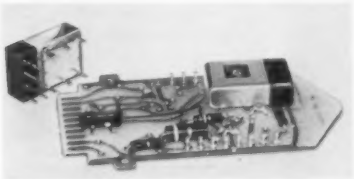
SET UP AS A JIG BORER

SET UP AS A JIG GRINDER

A QUALITY PRODUCT
BUILT FOR SUSTAINED ACCURACY and LASTING PERFORMANCE

MANEX MACHINERY CORPORATION
204 Central Park South New York 19, N. Y.
Telephone: Circle 6-5277
DISTRIBUTORS: A FEW TERRITORIES OPEN. WRITE.
Use Reader Service Card, CIRCLE 66

Corporation. The modularly designed ceramic capacitors and side-mounted relays are packaged to meet requirements of the 0.100 inch gridding used on standard printed circuits, and will not project further than the 0.400 inch limit required for plug-in card components.



Subminiature electronic components show stability over wide range of operating temperatures.

The ceramic capacitors range from 47 μuf to 56,000 μuf. Available in parallel lead, axial or feed through configurations, the tiny capacitors are stable over a full range of operating temperatures from −55 to +150 C, with capacity variations limited to ±10 percent of room temperature capacitance. They may be ordered with tolerances of plus or minus 5, 10 and 20 percent with GMV −0 percent, +100 percent.

Rated at 200 WVDC, the EC Ceramic Capacitors have a power factor of 2.5 percent at 1KC or 1.0 percent at 10KC. They withstand the most rigorous environmental extremes and are coded with nonfading colors which will not flake, chip or rub off. They are recommended for blocking and bypass applications requiring compactness, low power factor, high working temperature, and maximum reliability.

REWORK COSTS REDUCED BY SONIC ENERGY SYSTEM

Annual savings of $28,000 on reduction of rework and scrap, and savings of $10,000 in the reduction of inspection costs are being effected by the use of sonic energy cleaning in the production of precision gear assemblies with microbearings. The gear assembly parts previously had been cleaned by hand brushing and dipping in a 100 percent chlorinated solution.

Rejects due to contamination, previously averaging 56 percent, have been entirely eliminated by processing the parts in a Bendix sonic energy cleaning system, using a solution of Bendix 25-1 (water detergent) and ammonium hydroxide at 140 to 160 F. Necessity of two inspectors was eliminated at a saving of approximately $10,000 annually.

GAS • OIL • ELECTRIC • DIRECT FIRED OR ATMOSPHERE CONTROLLED

Production Heat Treating Equipment

of any of these types

○ BATCH ○ CONVEYOR ○ ROTARY
○ CAR TYPE ○ SHAKER HEARTH
○ ROLLER TYPE ○ WALKING BEAM

Working With These Materials:
Aluminum • Brass • Cast Iron • Copper
Malleable • Stainless • Steel

For Any of These Processes:
Annealing • Brazing • Carburizing • Carbo-Nitriding
Carbon-Restoration • Forging • Hardening
Normallizing • Sintering • Tempering

HOLCROFT & COMPANY

6545 EPWORTH BLVD. DETROIT 10, MICHIGAN TYLER 4-5700

43 YEARS OF ENGINEERING LEADERSHIP

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SOLID-WALL INSULATION
Highest quality graded fire-brick and block insulation. Greatly reduces heat loss, maintenance and operating costs.

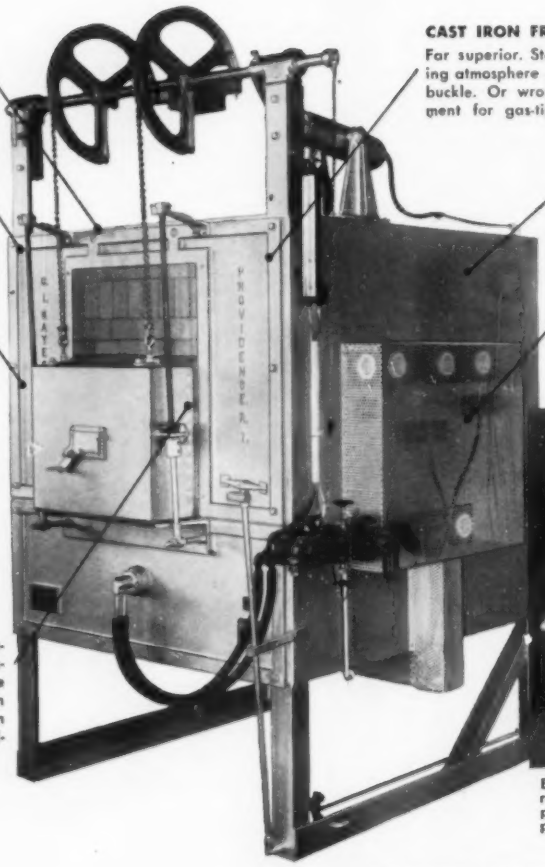
SYNTHETIC MULLITE REFRACTORIES
Outlast all other refractories many times over. Extra stable at high temps — won't slump, crack, spall.

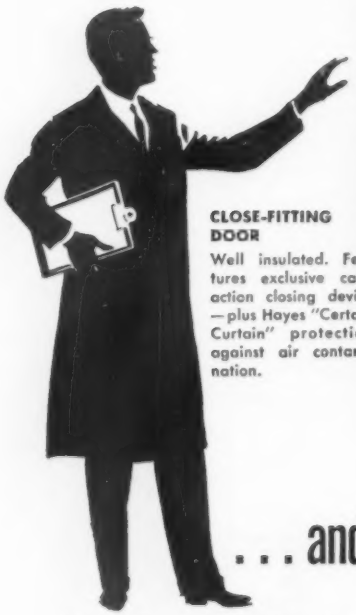
LOW-WATT DENSITY HEATING ELEMENTS
Nickel chromium ribbon or new thru-type ceramic rods. Extra long life — minimum of hot spots, arcing, fusing.

CAST IRON FRONT PLATE
Far superior. Stands up in burning atmosphere — won't warp or buckle. Or wrought steel weldment for gas-tight construction.

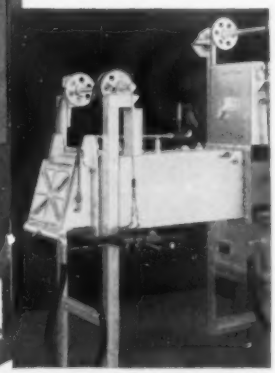
GAS-TIGHT SHELL
Reinforced steel plate. Compact, extra-sturdy, maintenance-free design.

AUTOMATIC TEMPERATURE CONTROL
Includes controls, thermocouple and leads, magnetic contactor. Wide choice of accessories.





CLOSE-FITTING DOOR
Well insulated. Features exclusive cam-action closing device — plus Hayes "Certain Curtain" protection against air contamination.



Easily adapted to critical work requiring low dewpoint atmospheres, by addition of muffle and pre-heat chamber.

. . . and talk about furnace FLEXIBILITY!

Versatility multiplies the value and economy of any good heat treating furnace. That's why Hayes Standard Type LR Preheat and CG Superheat Furnaces are designed to handle almost limitless hardening and annealing applications. Used with Hayes external generating equipment, these two furnaces are readily adaptable to reducing, as well as oxidizing atmospheres . . . for treating virtually all types of steels and many non-ferrous metals.

Both the Hayes LR Preheat Furnace and the CG Superheat Furnace are often called "spare tire" furnaces. Each features Hayes patented "Certain Curtain" atmosphere control, which acts as an *emergency stand-by* when external gas generating equipment is not in use.

Before you select *any* furnace, compare it with Hayes for job flexibility . . . plus operating economy . . . plus *all* these quality-construction advantages!

Results Guaranteed!

Write today for Bulletin 461

ELECTRIC CERTAIN CURTAIN FURNACES

C. I. HAYES, INC.

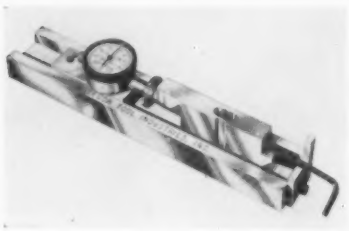
Established 1905

857 WELLINGTON AVE. • CRANSTON 10, R. I.

TOOLS of today

Tool Checking Gage

Instant, accurate reading of adjustable boring and reaming tool diameters can be made with this gage. It permits adjustments to 0.0001 inch in approximately 10 seconds per tool.



For adjustment of tools of the same size, the setting of one tool is read with a micrometer to establish the desired size, the tool is placed in the holder and the indicator is adjusted to a zero reading. Each succeeding tool is adjusted in the same way.

In adjusting tools of various sizes, each tool is miked, placed in gage, and expanded to desired size. Amounts of adjustment in 0.0005-inch measurements are read on the indicator face. Indicators graduated in 0.0001 inch are optional.

Muskegon Tool Industries, Inc., Muskegon, Mich. **Circle 350**

Magnetic Holding Bar

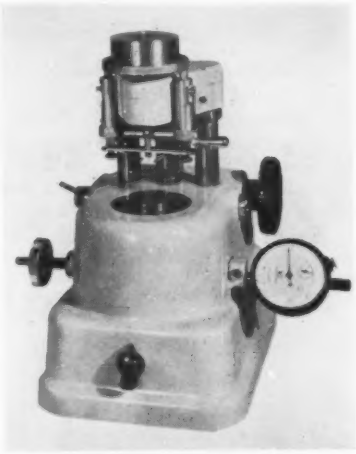
A permanent, nonelectric magnetic unit can be used for holding or controlling parts in handling or conveying operations, or as a separator to remove iron fines or tramp iron.

The 1 x 1-inch bar is obtainable in widths of 4 through 72 inches, in two-inch increments. Stainless steel mounting brackets are adjustable from ¼ to ½ inch in depth and can be removed for direct mounting.

Erie Mfg. Co., Erie, Pa. **Circle 351**

Microhardness Tester

Rubber, rubber-like and plastic materials can be tested for hardness with the Model H5 Wallace dead load microhardness tester. This eliminates the need to mold standard size test specimens and permits the hardness of small parts, sheets and irregular shapes to be directly measured.



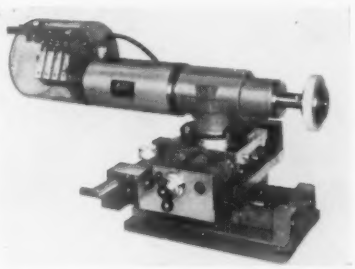
Depth of indentation is electronically measured, giving accurate readings on specimens less than 0.5 mm (0.01969-inch) thick. Other models measure rigid plastics and thin surface coatings.

Testing Machines, Inc., 72 Jericho Turnpike, Mineola, N. Y. **Circle 352**

USE READER SERVICE CARD ON PAGES 303 OR 453 TO REQUEST ADDITIONAL TOOLS OF TODAY INFORMATION

Grinding Spindle

Equipped to operate at 1000 amp, this Anocut spindle (P-19163-AN) for electrolytic grinding has a 2 hp, 3600 rpm motor. It is mounted on a heavy duty universal slide, to which are attached large dial indicators for measuring feed of the work in ten-thousandths of an inch.



The spindle has built-in insulation and fork type, cool operating brush assembly for transmitting low voltage, high amperage current to the grinding wheel. The spindles are motorized or belt driven to run with wheels up to 28-inch diam, and are available to operate at from 50 to 3000 amp at speeds up to 10,000 rpm. Total eccentricity of the shaft is less than fifty millionths of an inch.

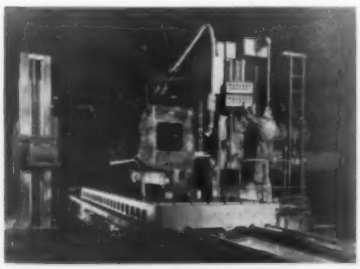
Pope Machinery Corp., 261 River St., Haverhill, Mass. **Circle 353**

Numerical Control System

The numerical control system on the horizontal boring mill illustrated permits work to close accuracies, lessens error and minimizes nonproductive time. It utilizes modular construction with heavy duty printed circuits. The control system is designed in building-block fashion, permitting progressive steps to full tape control. Starting with the basic positioning system, it is possible to add controls for the dialing of coordinates and full tape control as desired.

The system's display gage reads to three decimal points for each axis and

registers over-all accuracies to 0.001 inch. There is no accumulated error, line voltage variations have no effect, and there is no thermal drift. Traverse



rates are up to 360 ipm. The Space Setter is available for any number of axes on the company's horizontal milling and boring machines and on planer type milling machines.

G. A. Gray Co., Cincinnati 7, Ohio. **Circle 354**

Electronic Safety Control

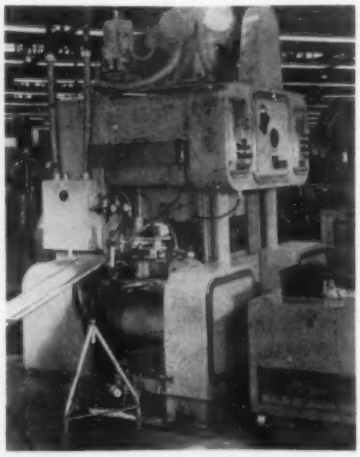
Protection of personnel and machines against injury is provided with a safety control which leaves the work area accessible and unobstructed. The machine-mounted sensing element, of conductive conduit, is easily shaped to required boundaries of the restricted area without interruption of production or feeding operations.

Model 500-1B surrounds the work zone with a radio-like field. If a hand, tool or other object enters the danger area, an actuated relay stops the machine. Operation will not resume until the object is removed. If desired, cam limit switch will nullify the field during the machine's upstroke.

Security Controls, Inc., 503 Franklin St., Buffalo 2, N. Y. **Circle 355**

Gearless Press

This high-speed metalworking press, without any gears in the drive mechanism, blanks at a rate of 450 strokes or 900 pieces a minute. Three separate crankshafts, joined by solid connecting rods, drive a rotating frame in which the upper die is mounted. The gearless design reduces noise and backlash and prevents multiplication of inaccuracies often incurred by gears and in other methods of linkage.

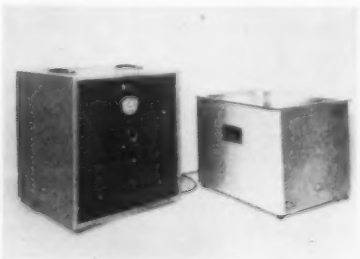


The press provides an increase of 30 to 40 percent in die life and 35 percent reduction in die maintenance, through high punching speeds. This makes possible production runs of 200,000 to 500,000 pieces between die grinds on silicon steels and longer runs on milder stock.

Wean Equipment Corp., 22800 Lakeland Blvd., Cleveland 17, Ohio. **Circle 356**

Ultrasonic Cleaner

Cleaning of parts at average energy levels can be done with this unit. Model 160 has a 13-gal tank with a radiating surface of 96 sq inches. The unit



can be adjusted to available line voltage. Operating at 115 volts a-c, the generator has a power output of 500 watts and peaks of 2000 watts.

National Ultrasonic Corp., 111 Montgomery Ave., Irvington 11, N. J. **Circle 357**

Gear Honing Machine

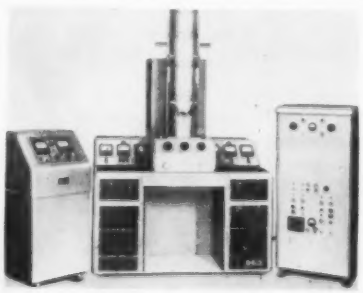
Four separate honing methods are provided by this compact gear tooth honer. The first method furnishes honing with backlash in conjunction with a locked honing head. A second gives zero-backlash operation and precision pressure control with the lock. The third method provides constant pressure operation with an automatic mechanical, wedge type backup eliminator. The fourth gives constant pressure operation with overload relief provided by an adjustable leaf spring backup protector.

The Model GHD honer can handle gears up to 12-inch pitch diam or, with automatic loaders, gears up to 4-inch pitch diam. The machine has a 5-inch stroke and uses a 10-inch diam honing tool. Manual, semiautomatic and fully automatic loaders are optional.

National Broach & Machine Co., 5600 St. Jean, Detroit 13, Mich. **Circle 358**

Electron-Beam Machine

Providing a versatile fabrication tool, the Zeiss process uses a controlled high density stream of electrons to change matter physically or chemically.



Used as a welding machine with stainless steel sheet stock for aircraft

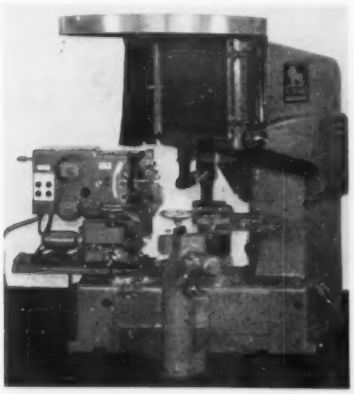
and missile structures, the process produces T sections 60/1000 of an inch thick at a rate of seven fpm. It will butt-weld ⅜ stainless steel at a rate of one inch every three seconds without distortions and with minimum grain growth in the weld area. Flexibility of machine design and the precise focusing of the electron beam permit welding of complex shapes in hard-to-weld metals.

Used for machining, the process permits drilling holes as small as 0.0008-inch diam in hardest materials. Energy density during drilling runs as high as 600 million watts per sq inch.

Hamilton Electrona Inc., 40 Wall St., New York 5, N. Y. **Circle 359**

Optical Profile Grinder

Automatic longitudinal and/or cross travel permits automatic grinding of flat faces and irregular profiles, since one-directional manual feed control is the operator's only job. A 20 x 20-inch shadowgraph screen has magnifications of 25 and 50X. The grinding wheel



slide has a 3⅜6-inch stroke and allows adjustments for lateral relief angles of 15 deg and axial relief angles up to 34 deg. Compound angles within these ranges can also be ground.

Reflection as well as shadowgraph projection is possible. Spindle and stroke drives are infinitely variable. Attachments are optional.

Eric R. Bachman Co., Inc., 27-11 41st Ave., Long Island City 1, N. Y. **Circle 360**

Mechanical Convection Oven

Conventional on-off type resistance thermometers and multiple switch type controls are replaced in the 60 Series of mechanical convection ovens by a saturable power reactor controls system.

The horizontal airflow ovens utilize the reactor in combination with a stainless steel hydraulic bellows and variable gap inductor coil which automatically varies voltage (wattage) to the resistive load. The system is stepless, switchless and infinitely proportional.

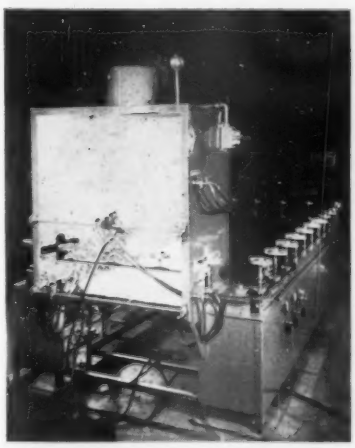
Temperature is constant, straightline and repetitive throughout the oven range.

The ovens are available in five sizes of from 1 to 24 cu ft and in two temperature ranges, 350 and 650 F.

Blue M Electric Co., 138th & Chatham St., Blue Island, Ill. **Circle 361**

Spray Finishing Machine

Painting from above and/or beneath, continually or by skip-spray, can be done with this automatic finishing unit. Any number of workholders, from a



minimum of 15, can be supplied on centers to suit size of part, loading and drying time. The conveyor is equipped with variable speed drive and can be equipped to revolve the piece part.

Control button, air filter and valve lubrication are standard; bake ovens, heat lamps, gas-off and cool-off tunnels are optional. Exhaust capacity is determined by the application.

Conforming Matrix Corp., 381 Toledo Bldg., Toledo 4, Ohio. **Circle 362**

Transfer Molding Presses

A series of presses includes Model 741 in 50, 75 and 150-ton (illustrated) capacities and Model 743, a 300-ton unit. Controls are arranged for either continuous, fully-automatic operation or intermittent manual or semiautomatic operation.

Pressures in the clamping and transfer rams are independently controlled. Special valving arrangements permit pressure adjustment up to full capacity of the presses. The units have a high-speed, low-pressure approach and closing phase, followed by a slower-speed high-pressure final phase and a high-speed transfer phase. Vibratory bowls automatically feed preforms into the preheater and conveyor carries the heated preforms into the mold.

F. J. Stokes Corp., 5500 Tabor Rd., Philadelphia 20, Pa. **Circle 363**

USE READER SERVICE CARD ON PAGES 303 OR 453 TO REQUEST ADDITIONAL TOOLS OF TODAY INFORMATION

Roller-Burnishing Tools

Adjustable roller-burnishing tools will finish bored holes in any machineable metal to 4-15 microinch surface smoothness in seconds, eliminating honing and grinding operations. The tools are easily mounted on drill presses, lathes, and screw machines, quickly set, and will produce several hundred finished pieces per hour.

IT'S A FACT

YOU CAN DO BETTER WITH

DE-STA-CO

TOGGLE CLAMP DELIVERY

BECAUSE, with stocking Distributors from coast-to-coast, you can always get quick delivery of the right clamps for the work at hand . . . WHEN YOU NEED THEM!

Whatever the size or shape of the piece to be held—wherever you have to push, pull or lock with forces from 50 to 10,000 pounds—it's a hundred-to-one there's a DE-STA-CO Toggle Clamp in stock to fit the job exactly.

FOR YOUR NEARBY DISTRIBUTOR CONSULT YOUR YELLOW PAGES!

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Use Reader Service Card, CIRCLE 69

TOOLS of today

The self-feeding tools are recommended for all metals of less than 35 R_C hardness. Best results are obtained on finishes of 120 to 150 microinches with a peak-and-valley feed pattern of 0.010 to 0.015 ipr.

The tools are available in every 1/64-inch increment in sizes from 0.375 to 0.484 inches, and in every 1/32-inch increment in sizes from 0.500 to 7.437 inches. They are made for through-hole and blind-end burnishing and for various bore depths.

The Gustave Wiedeke Co., Dayton 1, Ohio. **Circle 364**

Paste Solder Dispenser

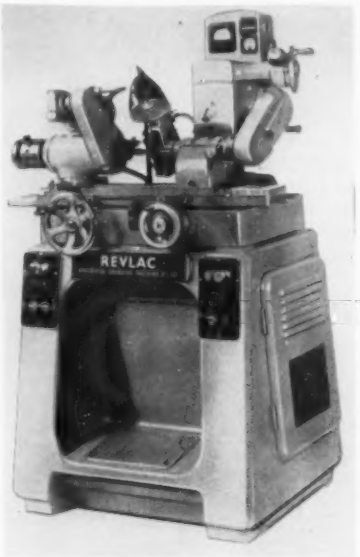
Automatic soldering at rates of up to 8400 joints per hour per machine can be done with this electronically operated paste solder dispenser. Electronic

eye control permits cycling in excess of 10 times a second. The timer cycles six times a second, controlling an air solenoid valve which activates the solder application gun.

Fusion Engineering, 17921 Roseland Ave., Cleveland 12, Ohio. **Circle 365**

Three-Way Grinder

External, internal and surface grinding can be done by this single unit which requires only simple, quick conversion to change grinding types. To change from chucking or face plate to center work, the work head is swung around through 180 deg. Mounting of the proper quill provides for internal grinding. Change to surface grinding requires swivelling of the head through 90 deg and mounting of a chuck or holding fixture.

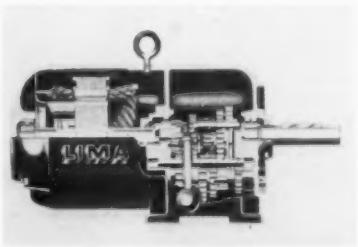


The Tri-Grinder takes work up to nine inches between centers. Table travel is 12 inches. Both spindles have a visual speed-indicator dial. Capacity of the grinding spindle is more than 40,000 rpm.

Russell, Holbrook & Henderson, Inc., 292 Madison Ave., New York 17, N. Y. **Circle 366**

Selective-Speed Drive

Redesigned internally, the Type R3 selective 4 or 8-speed gearshift drive can be mounted in any required position with the output shaft up or down. The

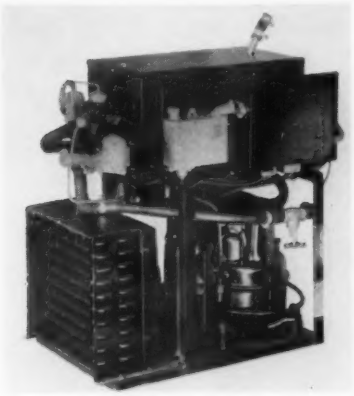


drive is furnished with single-speed motors of 1800, 1200 or 900 rpm. Two-speed motors are available. Gear ratios are: Low, 4.15:1, 2nd, 3.15:1, 3rd, 1.85:1 and High, 1.00:1. Comparable output speeds are 420, 555, 930 and 1730 rpm.

The Lima Electric Motor Co., Inc., Lima, Ohio. **Circle 367**

Liquid Chiller

Temperature of water, liquid chemicals or acids, and many types of corrosive or noncorrosive liquids, is closely controlled by this liquid chiller. The units can be used for tool quenching, product cooling during manufacture and in other operations.

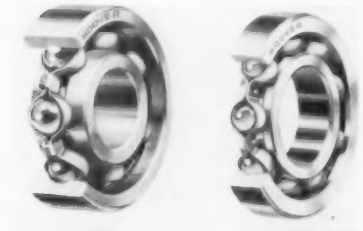


Models are available in ¼, ⅓ and ½-hp sizes, with air or watercooled condenser to maintain bath temperatures in ranges of from −30 to +75 F within ± 2 F, ± ½ F or ± 1/10 F. Models with a temperature range of from +15 F to +75 F are equipped with a corrosion-resistant nylon pump.

Remcor Products Co., 321 E. Grand Ave., Chicago 11, Ill. **Circle 368**

Ball Bearings

Two series of ball bearings—one with inch dimensions, the other with metric dimensions—are available either open or shielded. The R series (right) is proportionally similar to light and extra-light series metric bearings, and available in 15 sizes for shafts ranging from ⅛ to 1½ inches in diam. The series has inch dimensions for bore, OD and width.

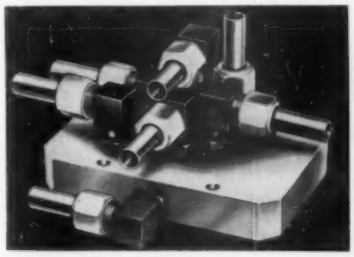


The 30 series (left) is made to metric boundary dimensions with bore sizes ranging from 4 to 9 mm in diam. Bearings of this series can be equipped with a single or double seal.

Hoover Ball and Bearing Co., 5400 S. State Rd., Ann Arbor, Mich. **Circle 369**

Self-Seating Fitting

Designed for use in hydraulic, pneumatic, lubrication, instrumentation and other fluid systems, this fitting makes a



positive metal-to-metal seal and requires no swing clearance. It is straight-threaded and consists of a stem and body with a floating nut.

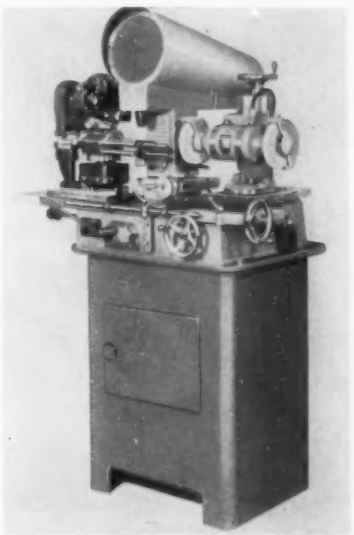
The Self-Seat is available in sizes from ½ to 2-inches OD and in all conventional shapes. A self-flare fitting or no-flare and flare type connections are available on the body.

Flodar Corp., 16911 St. Clair Ave., Cleveland 10, Ohio. **Circle 370**

USE READER SERVICE CARD ON PAGES 303 OR 453 TO REQUEST ADDITIONAL TOOLS OF TODAY INFORMATION

Optical Comparator

Special adaptors make it possible to mount this optical comparator on many makes of grinders. The nine-inch diam screen is mounted on a graduated protractor ring equipped with a five-minute vernier. The unit has a 20X magnification lens and 20X toolmaker's chart.



Lenses with magnifications of 10X and 31.25X are available.

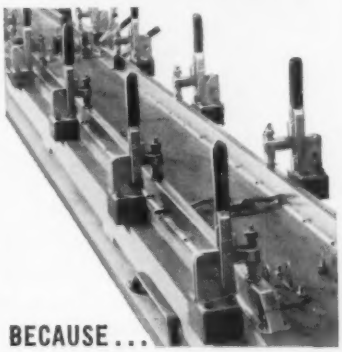
R-O Mfg. Co., 31171 Stephenson Hwy., Madison Heights, Mich. **Circle 371**

IT'S A FACT

YOU CAN DO BETTER WITH

DE-STA-CO

TOGGLE CLAMP ADAPTABILITY



BECAUSE...

There's always the right DE-STA-CO clamp for the job—no matter what the size or shape of the workpiece you have to hold. Choose from 13 standard styles, over 140 models or have DE-STA-CO engineers adapt one for you. Push, pull or lock with forces from 50 to 12,000 pounds! Quarter-, half-, and full-scale Templates available.

FOR MORE FACTS
CHECK BOOTH 1054
DETROIT TOOL SHOW
YOU CAN
DEPEND ON DE-STA-CO

DETROIT STAMPING COMPANY
350 MIDLAND AVENUE
DETROIT 3, MICHIGAN
DE-STA-CO

Use Reader Service Card, CIRCLE 70

Announcing the Van Keuren
THREAD RING COMPARATOR

It does the job
FASTER and EASIER
than rings
AT LESS COST

If you use THREAD RING GAGES in your production line, the new VAN KEUREN THREAD RING COMPARATOR will dispense with many gages and much labor cost — in providing quick, accurate and repetitive measurements.

The Van Keuren Thread Ring Comparator is a production gage for checking external threads up to ¾" diameter.

Gages both full form and pitch diameter • Sets and checks quickly

Gives uniform results. Repeats to .0002" • Long lasting — has no pivots

Write for descriptive literature or call your nearest Van Keuren representative for demonstration. Literature is available covering our full line of Thread Gages and other measuring equipment.

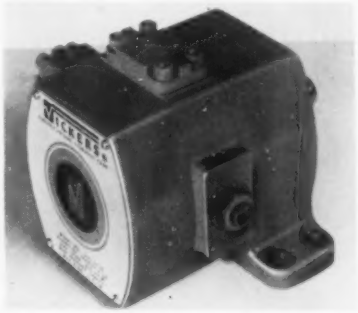
VK

THE Van Keuren CO.
Since 1920
174 Waltham Street, Watertown 72, Mass.
PRECISION MEASURING TOOLS
. . . rated the world's most accurate
Plug Gages · Measuring Wires · Optical Flats and Light Wave Equipment · Gage Blocks · Precision Lapping Service and Parts

Use Reader Service Card, CIRCLE 71

Variable Vane Pump

Specifically designed for machine tool drill feed and automation applications, this 6 gpm delivery unit can also be used in circuits that require pump delivery to vary according to system needs while maintaining preselected adjustable pressure.



Variable volume and pressure compensation features eliminate relief valves and attendant piping. The unit is designed for use at operating pressures up to 500 psi, operates at 1800 rpm, and can be flange, foot or gasket mounted.

Vickers, Inc., Detroit 32, Mich. **Circle 372**

Machining Heads

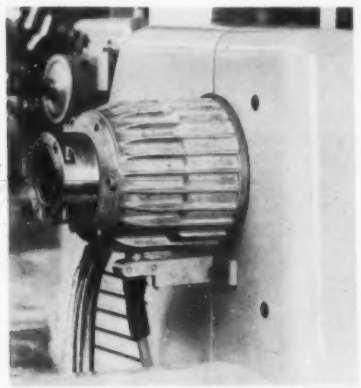
Linear as well as rotary motion is provided in the 21K and 21L series of tools for use in drilling, tapping, fastening, grinding, reaming, counterboring and wire brushing. Length of the stroke can be adjusted to micrometer accuracy over the 0.0 to 2-inch range. Tools can be operated singly or in groups, following any desired sequence and with controls matched to the desired degree of automation.

Both series have standard heads that employ an integrated needle valve to control feed rate without affecting spindle speed. Stroke control accessories can be attached at any point on the exposed piston rod.

Buckeye Tools Corp., 5003 Springboro Pike, Dayton 1, Ohio. **Circle 373**

Hydraulic Chuck Actuator

Used to operate power chucks, collets and other holding devices on machine tools, the Gamet chuck actuator can be operated at pressures up to 500 psi. Four standard sizes provide thrust of up to 13,500 lb. Thrust capacity of up to 23,000 lb is available on special order.



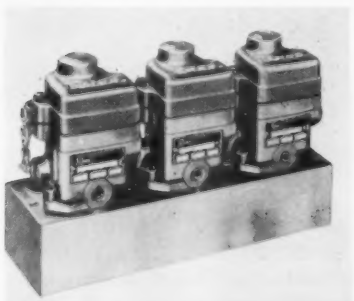
The actuator's center hole (up to 3 inches ID) can be used to hold bar stock or long workpieces, introduce coolant to the ID of the workpiece, permit drilling or other machining of the back of the workpiece, or to house a mechanism for automatic ejection of the finished work.

PowerGrip, Inc., Rockfall, Conn. **Circle 374**

USE READER SERVICE CARD ON PAGES 303 OR 453 TO REQUEST ADDITIONAL TOOLS OF TODAY INFORMATION

Multistation Manifolds

Two and three-station manifolds mounted with Pacer valves provide a compact, economical method for multiple mounting of air valves. Supply line, electrical conduit, lubricator and



filter serve all models, with a reduction of piping and conduit requirements.

Ross Operating Valve Co., 120 E. Goldengate Ave., Detroit 23, Mich. **Circle 375**

The FRINGECOUNT* at the DoALL Company

solves millionth of an inch gaging problem

The FRINGECOUNT micrometer plays an important part in the manufacture of DoALL Gage Blocks, including the newly announced stainless steel gage blocks. DoALL blocks at each stage of manufacture are checked against working Master Gage Blocks and these, in turn, are checked against Grand Masters calibrated by the Bureau of Standards.

Between calibrations by the Bureau of Standards, the accuracy of DoALL masters is regularly checked by the FRINGECOUNT micrometer. The speed with which this instrument measures directly, using light waves, permits all master gage blocks to be kept under constant surveillance. This vigilance is reflected in the unvarying accuracy of DoALL gage blocks.

This is just another one of the many jobs the FRINGECOUNT is performing for industry. This unique instrument provides absolute dimensional measurements to an accuracy of one-millionth of an inch under properly controlled conditions. It is simple to operate—designed for use by industrial gage personnel.

*Trademark of Link Division, General Precision, Inc.

Write Department TE, Industrial Sales, for new brochure on the Model 214 FRINGECOUNT micrometer.

See the Fringecount Micrometer at the ASTE TOOL SHOW April 21 to 28, Booth No. 2055.

LINK DIVISION

How can you make precision if you can't measure it?

GENERAL PRECISION INC.

BINGHAMTON, NEW YORK

Use Reader Service Card, CIRCLE 72

New V&O Ultra High Speed Press Scheduled for A.S.T.E. Debut

We are building what we think is the industry's fastest power press. We hope to have it ready for introduction at the A.S.T.E. Show. As of this writing, about two months before show time, it looks as if we will make it. But just in case we do not, we want you know it was not for lack of trying.

This new V & O press is truly high speed. We cannot tell you now what the maximum will be, but we can say it will be higher than anything envisioned by all except, possibly, the most forward-looking production executives.

To prove that it is a reality, here are some facts (which we hope will whet your desire to get more): it is a horizontal unit, incorporating a vertical crankshaft with flywheel, clutch and variable speed drive in the base of the machine for a low center of gravity; capacity is 25 tons; stroke is ¾"; it is equipped with double roll feed for 6" wide stock 4" max. length of feed and can be adapted for strip feeding from a magazine.

As a supporting attraction, we will have an automated unit for secondary operations. It will comprise a No. 2 V & O inclinable press equipped with an automatic press feed (V & O Feed-O-Matic) which is fed, in turn, by a vibratory hopper. This unit alone merits your consideration as a demonstration of how we can help you achieve automation on a practical basis, using available equipment.

You are cordially invited to drop by and see our latest development if it is built in time. Get the complete facts for a near-future look if it isn't on the show floor. The booth number is 1944.

Emhart Manufacturing Co.
Hudson Div., Hudson, N.Y.
Formerly V & O Press Div.

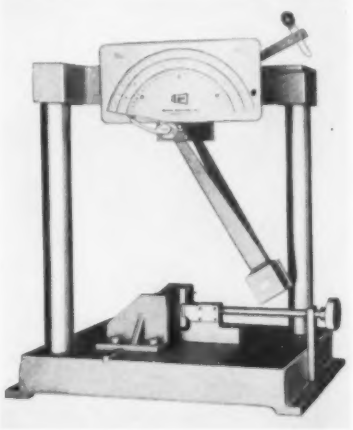
EMHART

Use Reader Service Card, CIRCLE 73

TOOLS of today

Tension Impact Tester

Tension impact modification of this standard impact tester provides information not otherwise obtainable with plastics, ceramics and other yielding materials. The unit incorporates a pendulum hammer with a two-jaw gripping

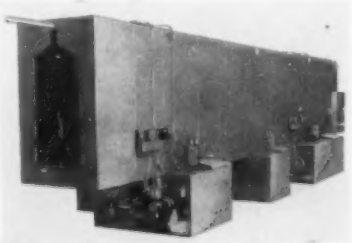


device that holds the specimen during the downward swing. At the moment of impact one part of the gripping device is arrested by a stop. The hammer continues its swing with the other part of the gripper and the specimen is pulled apart. Resistance to the tensile impact force is shown on the dial.

Testing Machines, Inc., 72 Jericho Turnpike, Mineola, N. Y. **Circle 376**

Power Spray Washing, Phosphatizing Units

Monorail and other types of conveyorized, stage-by-stage power spray washing and phosphatizing units provide flexibility for finishing programs through



addition or modification of units. Units can be selected according to size of work, number of finishing stages required and hourly production requirements.

Ramco Equipment Corp., 1379 Lafayette Ave., New York 59, N. Y. **Circle 377**

Screw Machine Chip Separator

High-production separation of either metal or synthetic material chips is done with this machine. Equipped with a feeder-vibrator unit, it will separate 1¼ cu ft of screw machine parts from

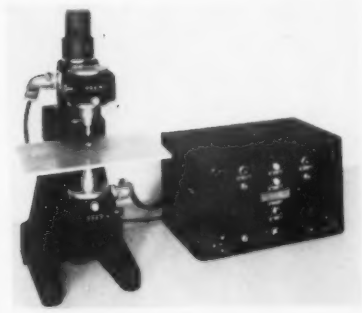
scrap chips in one minute. Fifty graduated settings regulate the blower unit, separating parts of from 1/16 to 2 inches in diameter and ¼ to 6 inches in length. The flow control hopper is preset.

The McKenzie Engineering Co., 78 S. Main St., Newton, Conn. **Circle 378**

USE READER SERVICE CARD ON PAGES 303 OR 453 TO REQUEST ADDITIONAL TOOLS OF TODAY INFORMATION

Electronic Micrometer

Model VDR is an opposed head device which permits pressureless measurement from two sides to the centerline of a fragile or compressible part.



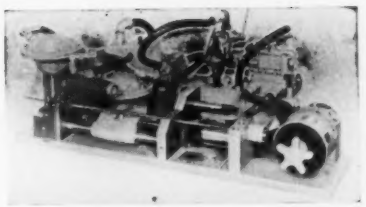
Opposing micrometer tips can be zeroed against each other at a selected reference position or at the anvil surface. Setups can be made using dummy parts and carriages placed between the tips at the desired point of measurement. Contact of tips is electronically controlled. Counters automatically display measurements to 20 millionths of an inch.

J. W. Dice Co., Englewood, N. J. **Circle 379**

Wire Feed, Cutoff Unit

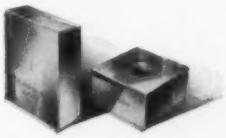
Easily adjustable to cut off wire in increments 1 to 6 inches in length, this self-contained unit accurately measures, feeds and cuts with an accuracy of 0.002 inch. The number of cutoffs per minute is adjustable; stop and start are electrically controlled; and wire sizes, within the range of the unit, may be changed without adjustment.

The unit illustrated has a "pay-off" spool with drag brake for feeding and cutting fine wire. It can be used with other types of coiled wire holding de-



vices. Units for wire sizes up to 3/16 inch with stroke lengths from 1 to 24 inches can be furnished.

Special Engineering Service, Inc., 7630 Wyoming, Dearborn, Mich. **Circle 380**



Accuracy, Stability, Wear Life

These are qualities to look for in gage blocks—qualities you'll find finest by far in Ellstrom Chromium Plated Standards. Size, flatness, parallelism unconditionally guaranteed to closer specified millionths than any other blocks you can buy. Made only of time-tested materials fully certified for uniform hardness, absolute metallurgical stability. And gaging surfaces chromium plated by an exclusive Ellstrom process to give you longer wearing millionths, lower gaging costs. Next time you buy gage blocks, be sure you get the very best—be sure to specify

ELLSTROM CHROMIUM PLATED GAGE BLOCKS

MANUFACTURED AND CALIBRATED TO THE INTERNATIONAL INCH—EXACTLY EQUAL TO 25.4 MILLIMETERS

"W" Working Accuracy: +.000008"/−.000000"
Parallelism: .000004" / Flatness: .000004"
"I" Inspection Accuracy: +.000004"/−.000000"
Parallelism: .000003" / Flatness: .000003"
"L" Laboratory Accuracy: +.000002"/−.000000"
Parallelism: .000001" / Flatness: .000001"

Above: Ellstrom Rectangular Set No. 85-R. Left: Ellstrom Square Set No. 81-SA, with accessories.

New Catalog contains prices and specifications—send for it today!

ELLSTROM STANDARDS DIVISION
DEARBORN GAGE COMPANY
22038 Beech Street • Dearborn, Michigan

Originators of Chromium Plated Gage Blocks

*Ellstrom—*Measuring in millionths for three generations*

Hjalmar Ellstrom (1863-1942)—He gave mankind the key to mass production of interchangeable parts. For it was he alone who conceived and produced the world's first combination gage blocks—the first master reference standards accurate to the infinitesimal millionth part of an inch!

Use Reader Service Card, CIRCLE 74

Draw Bending Machines

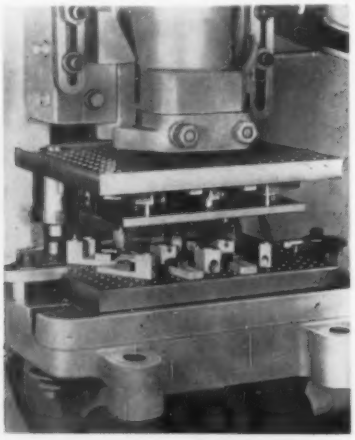
Hydraulic draw bending machines for use with thin-wall conduit and tube, operate with internal mandrels and bend

to close radii. Right and left-hand bending may be done with the same tooling. There is no restrictive minimum size for tubing.

Pedrick Tool and Machine Co., 3640 N. Lawrence St., Philadelphia 40, Pa. **Circle 381**

Adjustable Punch and Die Sets

Economical punching of a number of holes of varying size and shape can be done in one operation with an adjustable punch and die set. Shown assembled in a press, the sets can be used for both long and short production runs.



Materials as thick as 16-gage mild steel and ⅛-inch aluminum can be punched to tolerances of ± 0.005 inch.

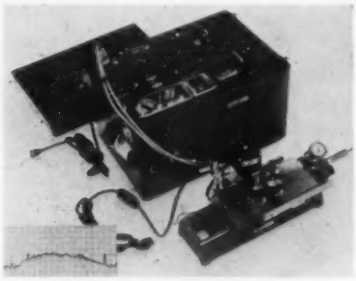
Each die holder has a self-cleaning slug chute, eliminating the need to bore holes in bolster plate. Additional punches and dies can be added without removing the die set from the press. All tooling is re-usable.

O'Neil-Irwin Mfg. Co., 625 Eighth Ave., Lake City, Minn. **Circle 382**

Electronic Gear Tester

Coupled with either the Scherr 2-inch and 5-inch gear testers or the Parkson 9 and 15-inch gear testers, the Sanborn electronic recorder completes an electronic gear tester. The same recorder can be used with any of the gear testers by mounting a transducer on each tester.

The recorder can be calibrated to any ratio within the limit of the recording



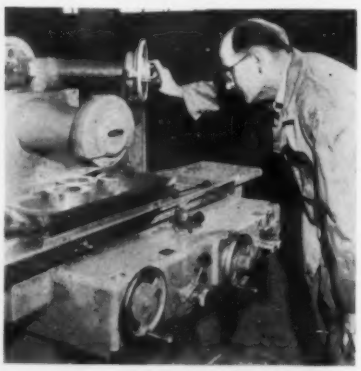
tape. One line on the paper can be made to equal from 0.00005 to 0.001 inch. A driving motor (optional) for the gear being checked can be wired to the recording tape switch control to make the gear and tape operate in unison, or it can be wired to an independent switch.

Temperature of the electrically heated stylus can be adjusted for a fine or heavy line. Gears can be checked in pairs or against a master gear if a master gear of each pitch and a driving gear of the same pitch for the driving motor are provided.

Scherr-Tumico Co., 200 Lafayetter St., New York 12, N. Y. **Circle 383**

Surface Grinder

Maximum table traverse speed of the Type S-3 surface grinder is 125 fpm, reducing grinding time as much as 50 percent over that of similarly sized machines and reducing burn, checking and cracking. The 8 x 24-inch unit will grind a workpiece as high as 12¾ inches under a 10-inch diam wheel. Long vertical ways provide rigid support even at

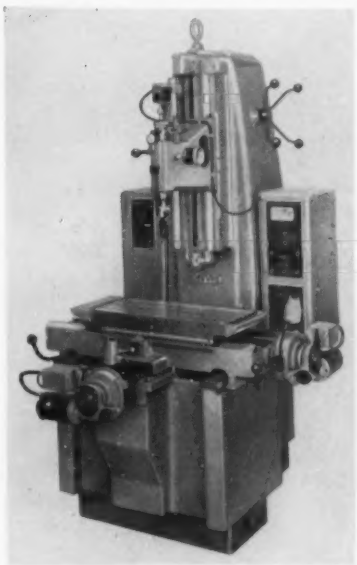


this height. The machine can be set up for wet grinding, dispersion of coolant through the wheel and electrolytic assist. Wheel drive motor is 2-hp and the hydraulic system is driven by a 1-hp motor. Optional equipment includes a vertical power positioning unit, magnetic or electric chucks with all controls, dust collection unit, intergral motor spindle, wheel guard truing and automatic downfeed.

Norton Co., Worcester 6, Mass. **Circle 384**

Measuring Machine

Measuring of large workpieces to exact tolerances can be done with this Model No. 3 machine that can measure one-third of a "tenth." It will handle



work 11 x 18 x 18 inches. Either an electronic indicator supported on a rotary spindle or a universal microscope for pickup can be supplied. A combination of rectilinear and angular positioning makes it possible to measure complex contours.

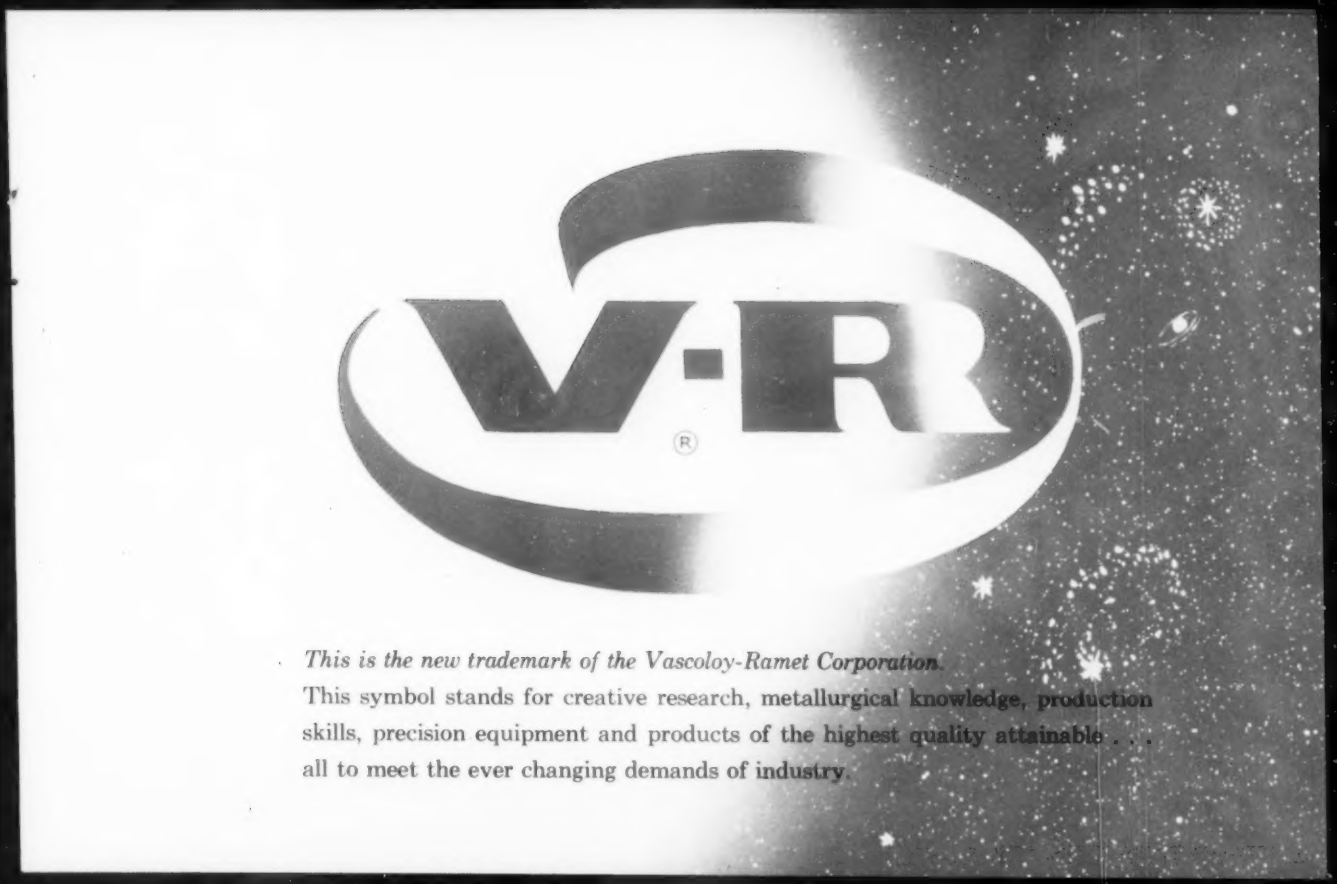
Moore Special Tool Co., Bridgeport, Conn. **Circle 385**

Fluxing Additive

Wes-X 501 acts as an adhesive to keep the flux close to the base metal in galvanizing and hot dip tinning processes. The additive eliminates the critical time between fluxing and hot dipping. It can be used in any aqueous flux bath, reduces the number of rejected or reworked parts, and makes hot dipping of cast parts easier.

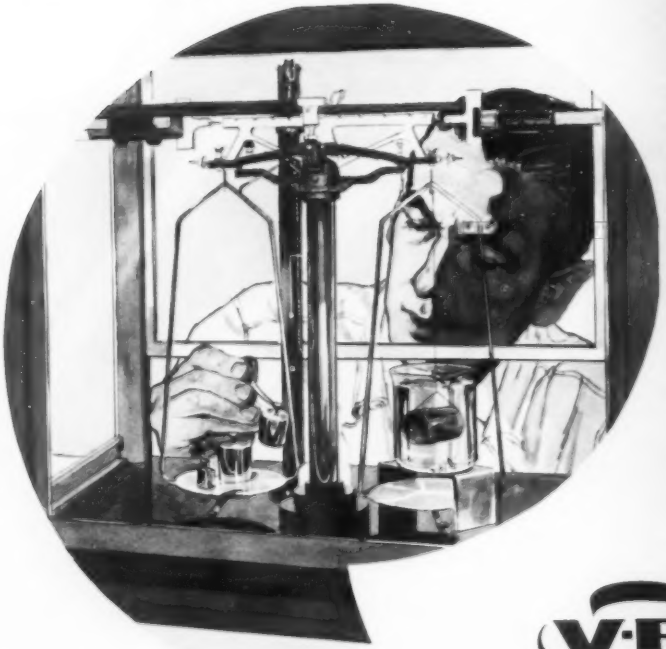
Westinghouse Electric Corp., P. O. Box 2099, Pittsburgh 30, Pa. **Circle 386**

(Continued on page 249)



This is the new trademark of the Vascoloy-Ramet Corporation.
This symbol stands for creative research, metallurgical knowledge, production skills, precision equipment and products of the highest quality attainable . . . all to meet the ever changing demands of industry.

CREATING THE METALS
THAT SHAPE THE FUTURE



New metals for new needs through metallurgical research

Years of research, experimentation and comprehensive testing have been devoted to every type of product being manufactured at V-R. By working closely with all types of industry, this metallurgical knowledge is effectively applied to meet industry's ever-changing demands for refractory metals. Whether you need better cutting tool materials . . . parts with greater resistance to heat, wear and corrosion . . . or intricate parts cast to close tolerances, then V-R research in refractory metals can be of help to you.

V-R VASCOLOY-RAMET

CREATING THE METALS
THAT SHAPE THE FUTURE

Quality starts with purity

There's no secret to producing quality products at V-R. It's a simple matter of starting with highest purity raw materials and maintaining this purity and uniformity throughout all production processes.

A good example of V-R's quality control is this X-Ray Fluorescent Spectrograph which tells the exact composition and amount of each component in the material being tested . . . assuring purity of raw materials and uniformity of powdered metal compositions.

V-R VASCOLOY-RAMET

CREATING THE METALS
THAT SHAPE THE FUTURE

Constant checking assures consistent carbide performance

The consistent performance of V-R carbide is largely due to the varied and frequent quality checks at every step of the production process. Here, we see a metallograph being used to check grain structure and absence of porosity against rigid standards. Similar checks are constantly made to assure proper hardness, density and transverse rupture strength. This elaborate checking system assures that each piece of a specific V-R grade will always perform the same.

V-R VASCOLOY-RAMET

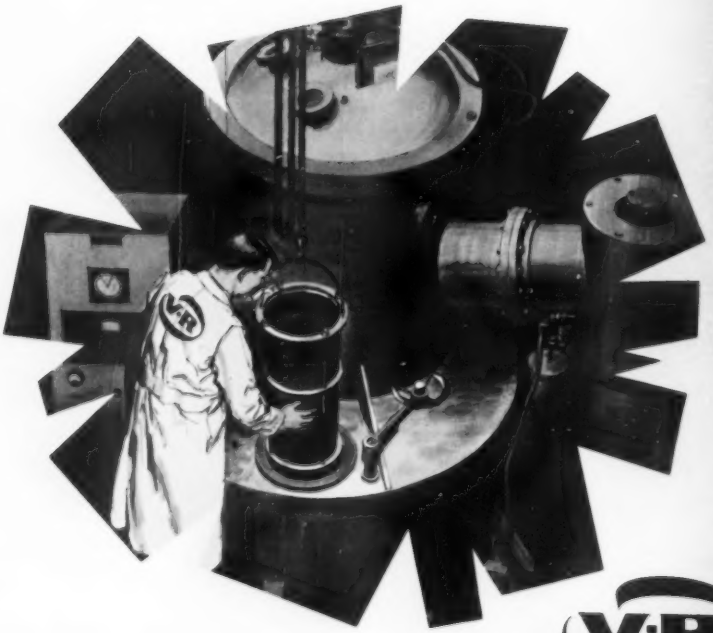
CREATING THE METALS
THAT SHAPE THE FUTURE

Precision equipment assures accurate shapes and sizes

No single method can produce all the sizes and shapes of products manufactured at V-R. For example, that's why five different pressing methods are used to meet industry's carbide needs. The press shown here is typical of modern accurate equipment used to compact carbide at V-R. Regardless of the method used, precision controls and the knowledge gained through long experience enable V-R to form metals to accurate dimensional requirements and proper density.

V-R VASCOLOY-RAMET

CREATING THE METALS
THAT SHAPE THE FUTURE



V-R vacuum sintering makes better cemented carbides

Vacuum sintered carbide grades are more versatile because precise control during vacuum sintering removes trace impurities . . . increasing the strength of V-R carbides and their ability to withstand cutting conditions which generate extreme heat. Vacuum sintering is one of the many reasons for the superior performance of V-R's new carbide grades for machining all types of steel and the new superalloys.

V-R VASCOLOY-RAMET

CREATING THE METALS
THAT SHAPE THE FUTURE

Finishing to customers' specifications

V-R from the first recognized industry's need for finished products ready for immediate use. People and equipment were then geared to manufacturing products to meet the varied specifications of industry. Thus, whether you use V-R metals in the form of blanks, inserts, brazed tools, wear parts, coal and rock bits or any of numerous other forms, you will find that V-R has the equipment and knowhow to fulfill your requirements.

V-R VASCOLOY-RAMET

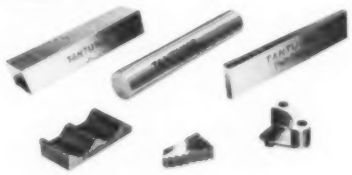
CREATING THE METALS THAT SHAPE THE FUTURE

Metals that shape the future take many forms . . . *cutting tools* for all types of machining operations . . . *parts* designed for extreme resistance to heat, wear and corrosion . . . *mining bits* for increasing coal production . . . *percussion bits* for helping build turnpikes, dams and tunnels . . . *metals cast* to close tolerances eliminating costly machining operations . . . but, regardless of the form they take, all V-R refractory metals are playing an important role in shaping a better future.

V-R CARBIDE

V-R CARBIDE is produced in a wide range of grades, each with different characteristics for specific uses. Available in all types of blanks, inserts and brazed tools for machining . . . balls, discs, rods, tubes, special shapes and parts that resist heat, wear and corrosion . . . a complete range of coal mining bits and percussion bits.

V-R TANTUNG



V-R TANTUNG is an exclusive cast alloy with high red-hardness, high transverse rupture strength, high shock resistance and low coefficient of friction. Widely used as solid tool bits, cut-off blades, cast-to-form shapes and tipped tools. Also, Tantung, because of its characteristics, is one of the more popular V-R metals used for investment casting of small, intricate parts.

V-R CERAMIC VR-97

V-R CERAMIC VR-97 is an entirely new aluminum oxide cutting material for ultra-high speed machining. It outperforms all other ceramics. Proven in continuous production, it provides a better finish, better size control and a longer tool life with speed flexibility.

VASCOLOY-RAMET

800 MARKET STREET • WAUKEGAN, ILLINOIS

A-779

Metal Fabricator

Need for pressurized air is eliminated by an electro-hydramatic head which controls the ram's power stroke in this machine. The unit is designed for punching, notching and nibbling, particularly for prototype work, in short or medium production runs.

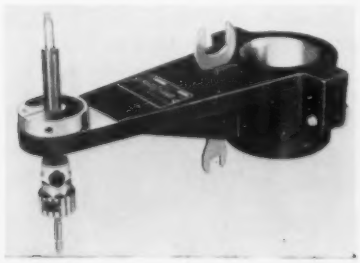
Model 15A punches round or shaped holes up to 3½-inch diam in sheet material up to ¼-inch mild steel. Maximum notching capacity is 5 x 5 inches in ⅛-inch mild steel. It will do straight line or contour shearing at 165 spm in ⅛-inch mild steel.

Wales-Strippit, Inc., 211 S. Buell Rd., Akron, Ohio. **Circle 387**

USE READER SERVICE CARD ON PAGES 303 or 455 TO REQUEST ADDITIONAL TOOLS OF TODAY INFORMATION

Tapping Attachments

Leadscrew attachments enable even unskilled workers to tap holes to exact specification without danger of thread damage. The unit illustrated can be used with any reversing type head to



convert a drill press into a precision tapping machine. A leadscrew and split nut are interchangeable, permitting tapping of a variety of threads.

Ettco Tool & Machine Co., Inc., 594 Johnson Ave., Brooklyn 37, N. Y. **Circle 388**

Thread-Miller

Internal or external milling of 60-deg, Acme, square or multiple threads in any type of plastic material and metal can be done with this machine. Its cutting action prevents distortion and maintains absolute concentricity in plastics. Pitch and root diameter and pitch angle are held to a tolerance of 0.001 inch. Undercutting is eliminated

and milling is completed in one pass, without overheating of material.

Cutters are available from ½ to 9 inches for internal threading, and from 1/32 to 9 inches for external threading.

Fen-Thread-Machine Co., Inc., 3107 N. Broad St., Philadelphia, Pa. **Circle 389**

Elevating Feeder

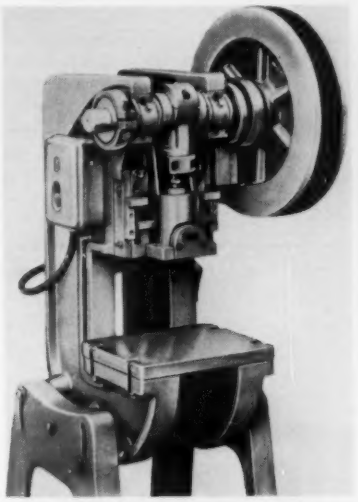
Feeding and orienting parts of a variety of sizes, shapes and materials to processing or assembly machinery can be done with this unit. The conveyor

will discharge to the right or left at desired heights. Drive speed is either fixed or variable and can be automatically controlled for demand feeding as parts are needed. Feeders are available with holding capacity of 6, 12 and 20 cu ft.

Detroit Power Screwdriver Co., Detroit 16, Mich. **Circle 390**

O.B.I. Presses

Twelve-ton presses can be had in O.B.I., deep throat and slow speed models. Built-in controls provide additional effectiveness to overload detectors



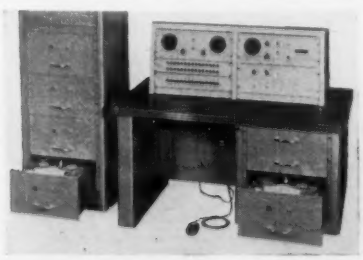
and adaptability of safety check monitors in automatic operation. Used in interconnected multiple units, the presses provide economy in stamping of long, narrow pieces.

Kenco Mfg. Co., 5211 Telegraph Rd., Los Angeles 22, Calif. **Circle 391**

Electronic Timekeeper

An electronic timekeeper improves timekeeping systems by recording actual reports and details from operators at the machine locations and arranging for posting according to any system desired and at the convenience of the records departments.

Telephone stations are interconnected and can be arranged for any number of channel recordings, each channel using

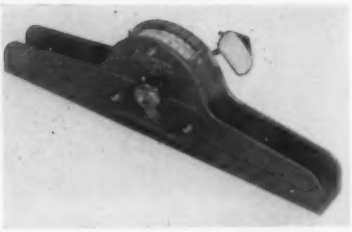


a separate tape recorder. Central station switchboard is equipped with recorder to re-record or dub as required for records and to completely control communication system. Controls are so interlocked that only one report may be recorded at one time on one recorder.

K.L.A. Laboratories, Inc., 7375 Woodward Ave., Detroit 2, Mich. **Circle 392**

Vernier Angle Gage

Used to determine any angle of inclination from the true horizontal plane, this Model A clinometer has an adjustable zero position, an improved shell molded case and a rust-protected 12-inch base. The portable instrument is gravity-operated, without gears or other mechanical linkage. Whole angles are measured on the main dial, minutes on



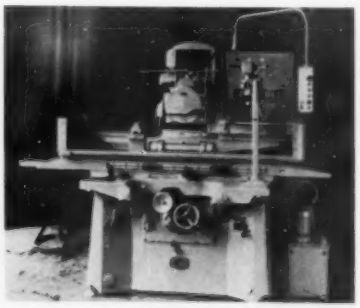
the vernier scale. The self-checking measuring range is 0 to 360 deg.

Engis Equipment Co., 431 S. Dearborn St., Chicago 5, Ill. **Circle 393**

Surface Grinders

Intricate profiles can be plunge ground on Blohm surface grinders, which can be equipped with wheel crushing and profiling attachments. Other attachments include a longitudinal duplicator for thread rolling die jaws and units for crush forming, heavy-duty wet grinding and wheel forming.

Three floating spindle bearings provide an efficient heat dispersion system which prevents freezing of the spindle through lack of lubrication. Ball bearing tables and cross carriages are accurate, smooth and sensitive in operation.

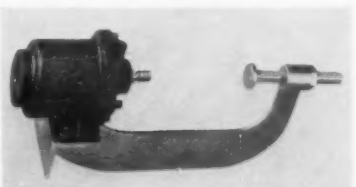


An infeed attachment provides push-button control for lowering the wheel to the workpiece in increments of 40 millionths of an inch. An optional automatic cycle control allows pre-setting of the required number of roughing and finishing cuts. Accuracy of flat and parallel grinding, over the total table surface, is within 50 millionths of an inch.

Hermes Machine Tool Co., Inc., 48-15 Northern Blvd., Long Island City 1, N. Y. **Circle 394**

Air-Powered Clamps

Manual sleeve or integral solenoid valves for automation applications are available with a line of air-operated "C" clamps. A heavy-duty series for high strength and durability or a low-cost

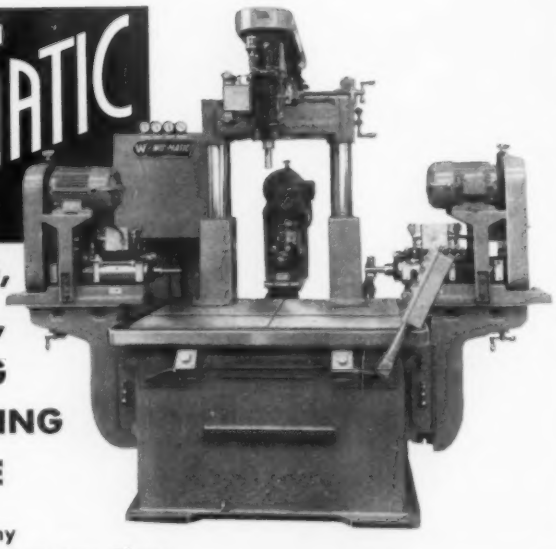


series for average applications are furnished. All clamps have a number of optional clamping ends and a choice of various power factors. Maximum openings range from six to nine inches.

Airmatic Valve, Inc., 7313 Associate Ave., Cleveland 9, Ohio. **Circle 395**

WISCONSIN

WIS-MATIC



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Write for Bulletin 560 or visit Booth No. 621 at ASTME Tool Show, Detroit, April 21-28.

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Small Mikes,
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Special Mikes

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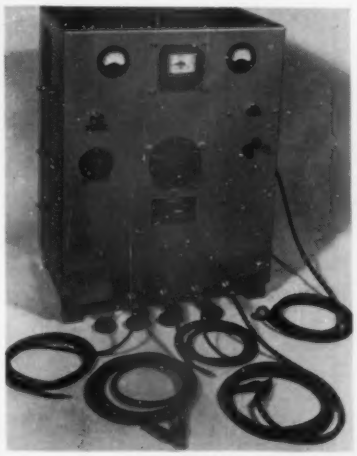
Plating Power Pack

Operating on 220 volts, single phase, 60 cycles, this portable power pack has an output up to 0 to 50 amps and 0 to 30 volts with stepless voltage control and a special amp-hr meter with 0.01 amp-hr divisions. Two positive leads with plugs and two negative leads with



clamps permit simultaneous plating and etching operations on two workpieces.

The Dalic process deposits any one of a large variety of metals on as many different types of base metal. Since tank immersion is eliminated, carefully selected areas of work may be plated without extensive masking or stopping off.

Sifco Metachemical, Inc., 935 E. 63rd St., Cleveland 3, Ohio. **Circle 396**

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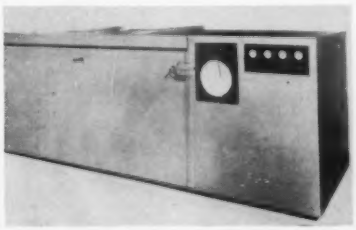
Low-Temperature Cooler

Fast processing and stabilizing of metal alloys such as AM-350 stainless steel, tatnoll, molybdenum, titanium and tantalum can be done with this



cooler. Temperature range of the unit is ambient to −140 F. Capacity is sufficient to lower the temperature of 300 lb of steel from +80 F to −125 F in one hour. Internal dimensions are 72 x 26 x 36 inches.

Webber Mfg. Co., Inc., P. O. Box 217, Indianapolis 6, Ind. **Circle 397**

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American Twist Drills are not readily available—The American Automotive Industry demands practically all capacity for precise, uniform mass production requirements. Eventually they will be available to all industry through selected Industrial Distributors.

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Detroit, Michigan
Subsidiary of:
Cutting Tool Division
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Providence 1, Rhode Island

AMERICAN

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Wilson "Rockwell" Hardness Testers can help make your products better, stronger, longer lasting. They give reliable results on the production line, in laboratories, in tool rooms, and in inspection departments. They're as easy to use as a center punch, as durable as a machine tool, as sensitive and accurate as a precision balance. That's why Wilson "Rockwell" is recognized as the world's standard of hardness testing accuracy.

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A perfect diamond penetrator is essential to accurate testing. Only flawless diamonds are used with Wilson "Brale" penetrators. Each diamond is cut to an exact shape. Microscopic inspection and a comparator check of each diamond—one by one—assure you of accurate hardness testing every time.

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for most hardness testing functions
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for extremely shallow indentations
TUKON
for precision micro and macro testing
AUTOMATIC—semi and fully automatic models for automatically classifying tested pieces at rates to 1,000 pieces per hour

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ACCO

Wilson Mechanical Instrument Division
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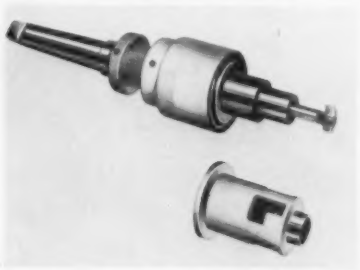
Recessing Tool

An interchangeable, snap-on work pilot adaptor permits piloting of this recessing tool in the work, as well as in a fixture bushing, on machines where

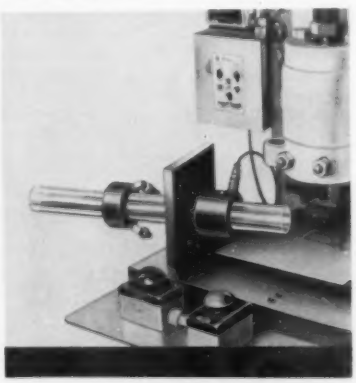


the spindle is turning. Three types of tools are made for work diameters from 0.375 to 2.250 inches and a depth of cut up to 0.281 inch. Cutter heads for varied applications are available, permitting completion of multiple operations in a single pass.

Madison Industries, Inc., 560 Mineral Springs Ave., Pawtucket, R. I. **Circle 398**

Proximity Switch

For use on any press or similar equipment in which a dog, pin, or air clutch is either electrically operated or can be modified to electrical operation, this proximity die saver switch instantly detects malfunction and automatically stops equipment.

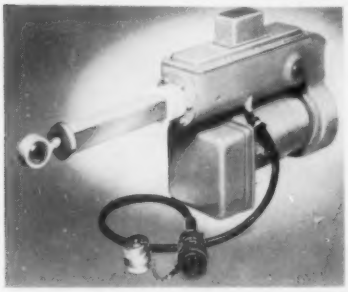


The press control keeps equipment operating automatically and efficiently with limited supervision and guards against die and equipment damage due to the multiple heading of parts. The unit can also serve to operate a production counter.

Robotron Corp., 21300 W. Eight Mile Rd., Detroit 19, Mich. **Circle 399**

Linear Actuator

First of a line of actuators designed for industrial use, Model 499B can move up to ¾ ton and hold 1½ tons. A brake is used to reduce overcoast.



Stroke of the heavy-duty electrically driven linear actuator is continuously adjustable from 4¼ to 4½ inches. The self-contained unit is powered by a single-phase 115-volt, 60-cycle motor capable of 0.14 hp at 5000 rpm.

Lear, Inc., Grand Rapids, Mich. **Circle 400**

Layout Spray Coating

Well adapted to the fine lines of precision work, a blue layout spray, packaged in 12-oz aerosol cans, provides smooth, dark, nonglare coating that dries instantly and will not rub off. The No. 603 spray's companion product is No. 606 layout fluid remover (16-oz),

which gives quick, clean fluid removal.

Industrial Supply Div., Sprayon Products, Inc., 2074 E. 65th St., Cleveland 3, Ohio. **Circle 401**

USE READER SERVICE CARD ON PAGES 303 or 455 TO REQUEST ADDITIONAL TOOLS OF TODAY INFORMATION

Compounded Lubricant

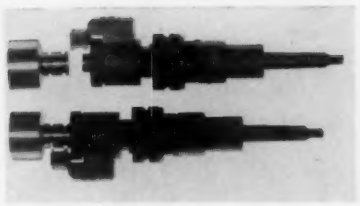
Cutting oil for difficult or critical machining operations prevents galling of both cutting tools and workpieces. Tool life is increased and surface finish improved in broaching, tapping and threading operations. The lubricant, brushed directly on cutting tool edges, is economical in application.

Hal Industries, Box 224, Wyckoff, N. J. **Circle 402**

Necking Cutter Attachment

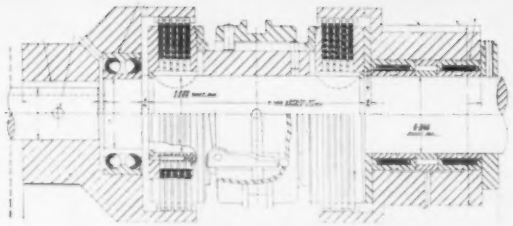
External machining can be done easily and more accurately with this necking cutter attachment mounted on a recess toolholder with adjustable stop collars that regulate the location and depth of the tool. Awkward or irregularly shaped workpieces can remain stationary while rotating the tool, or vice versa. The tool is illustrated in work position and retracted.

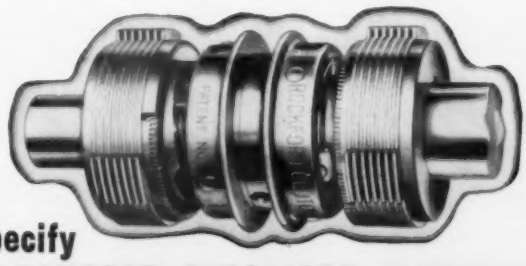
The attachment has a ball-bearing pilot to stop on or fit over the workpiece. It can be used for manual or mechanical feed with high-speed steel or carbide-tipped cutters.



Maxwell Industries, Inc., 493 E. 5th St., Ashtabula, Ohio. **Circle 403**

ROCKFORD





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For Longer Life

ROCKFORD PULLMORE CLUTCHES are specifically designed to fit perfectly on the shaft, giving instant, positive clutching and declutching. Precision adjustment for eliminating drag, heat or abrasion. These important factors give ROCKFORD PULLMORE CLUTCHES a much longer life. Complete customer satisfaction is given where a large torque capacity is needed within a compact design. Specify ROCKFORD PULLMORE CLUTCHES.

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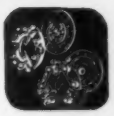

Small Spring Loaded

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CLUTCHES

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The MICROtrol® 170 is a transistorized gaging system for use at the machine, in the gage laboratory or on the production line. Production personnel find it simple to use. The four types of gage heads available can be used interchangeably with the battery-powered amplifier.

Features

- *Only 2 control knobs*
- *One adjustment zeros both scales*
- *Large meter with 4.6" scale*
- *Dual range—from either ± .0003" to ± .003" or ± .001" to ± .010"*
- *Accurate—transistorized throughout*
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Basic Gages start at $341.00

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TOOLS of today

Port Contour Cutters

Model AND 10050 port contour cutters for hydraulic fittings are available for use with tubing of ⅛ through 2-inches OD. The large-diameter spot-face

will through-machine larger bosses and provides extra diameter for special grinds. The cutters are carbide-tipped, have solid heat-treated tool steel bodies and are end piloted.

Wetmore Tool & Engineering Co., 5320 E. Washington Blvd., Los Angeles 22, Calif. **Circle 404**

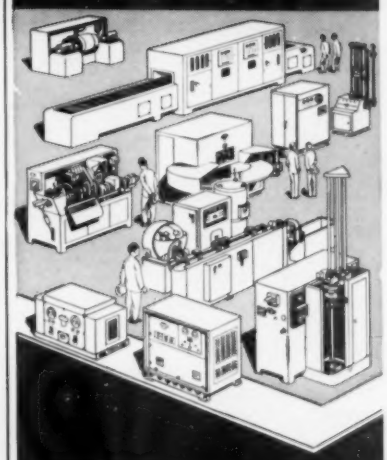
Feed Rate Indicator

Designed for use with machine tools utilizing pneumatic or hydraulic actuators, Model RF II assists the supervisor in monitoring the rate of feed of

machine tools. It can be used with vertical, turret type milling and drilling machines, horizontal and vertical boring machines, and others. The unit will monitor multiple speeds without field calibration or adjustments.

The Digitool Corp., 5300 Brownway Dr., Houston 27, Tex. **Circle 405**

for HARDENING • BRAZING
SOLDERING • FORGING • ANNEALING
MELTING • SINTERING • WELDING
REFINING • SHRINK FITTING
CRYSTAL GROWING



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INDUCTION HEATING EQUIPMENT

ELECTRONIC · LOW FREQUENCY
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- Over 20 years of concentrated experience.
- Over 5,000 installations.
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- This outstanding experience and know-how qualify us to prescribe the techniques and equipment best suited for your requirement.

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Write for New 56-page catalog of exclusive features, facts and specs.

INDUCTION HEATING CORP.
181 WYTHE AVE., BROOKLYN 11, N.Y.

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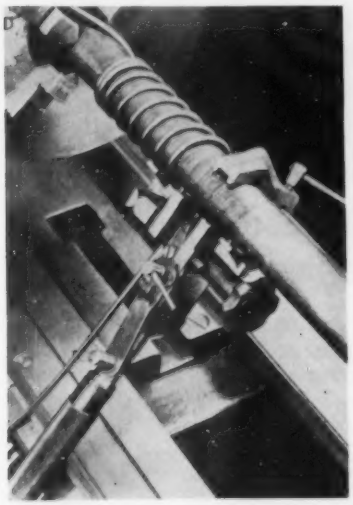
Spring Winding Attachments

Precision coil springs can be produced from round and square wire with this lathe attachment. It will produce cylindrical extension springs with variable initial tension and compression



springs with any desired pitch and closed ends. Three models of the tool accomodate wire sizes from 0.008 to 0.600 inch. With smaller wire sizes, the attachment can be used manually in a vise.

Collins-Faust Co., 18 Park End Place, Forest Hills 75, N. Y. **Circle 406**

Terminal Setter

Split lugs and feed-throughs as well as single-end terminals can be set with the Model FST-1 machine. The machine has an electric punch and vibratory

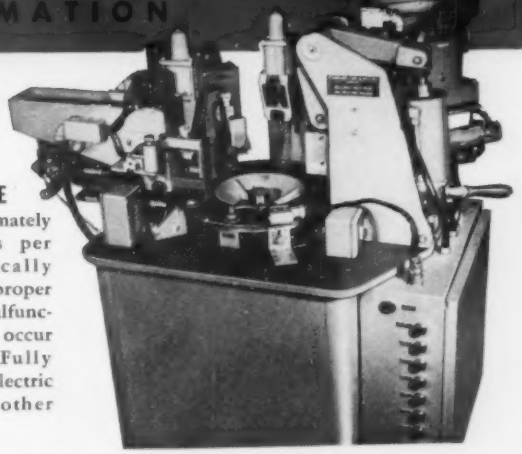
feeder, orienting devices, trackage, electrical controls and power feed which makes possible the setting of up to 100 terminals per minute. A variable voltage transformer provides impact up to 3500 lb. Stroke length is 1⅝ inches and throat depth is 4½ inches.

Black & Webster, Inc., 570 Pleasant St., Watertown, Mass. **Circle 407**

Specify

Standard Tool "building blocks"

AND LOWER THE COST OF AUTOMATION



8-STATION ASSEMBLY MACHINE produces approximately 1500 assemblies per hour, automatically indicates any improper loading or any malfunction which might occur at any station. Fully equipped with electric interlocks and other safety devices.

Rockwell Manufacturing Co., Hopewell Division, now automatically assembles 4 different size double ball check assemblies of two types with a machine designed and built by Standard Tool and Manufacturing Co. incorporating a model ST-A9A indexing unit, Standard Cabinet base, and other precision "building block" components.

See Our Exhibit BOOTH 1838 ASTE Show

OPERATOR MANUALLY LOADS ball check body at **Station 1** (All other operations are completely automatic.) **Station 2** Small ball is loaded. **Station 3** Impact tool forms ball seat. **Station 4** Larger ball is loaded. **Station 5** Impact tool forms larger ball seat. **Station 6** Pin is inserted to hold assembly, or, **Station 7** Top of body is crimped. **Station 8** Completed ball check assembly is ejected.

Changeover from one size or type to another is quickly accomplished and simplicity of design makes it foolproof.

The heart of this Automatic Machine is the ST-A9 indexing unit available in many sizes and types to meet most rapid assembly and manufacturing needs.

Technical Booklets Sent on Request!

Standard Tool engineers will be pleased to help you in selecting the indexing unit to meet your exact requirements.

Also ask for Standard Tool facilities brochure.

Machinery Division

STANDARD TOOL & MANUFACTURING CO.

Better Products at Lower Costs thru Better Methods

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STANDARD TOOL AUTOMATION

Since 1910

See our Exhibit at Booth #1838 ASTE Show

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detects angles to .1 second

even after 100-G shock test

universally accepted

MICROPTIC AUTO-COLLIMATOR

The master instrument to set up and check angles to .1 second over 10 minutes of arc. With simple accessories it establishes squareness, parallelism, flatness, angles, and circular spacing under normal shop conditions independent of distance and temperature. Used as standard for testing of surface plates and machine tool alignment, control of ultra-precision gear cutting devices, test fixtures and tables for missile guidance units.

New . .

The Microptic Auto-Collimator with photo-electric read-out, as original equipment and conversion unit.

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DIVISION OF ENGINEERING AND SCIENTIFIC INSTRUMENTATION
431 SOUTH DEARBORN STREET
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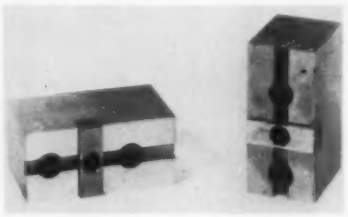
TOOLS of today

Soft Blank Chuck Jaws

Jaws for air chucks, hand or power-operated geared-scroll chucks, two and four-jaw independent chucks, and combination chucks are made in two heights and available in short-jaw (Style S) and long-jaw (Style L) models. Mounting faces are precision ground and close tolerances on tongues and grooves insure accuracy and interchangeability.

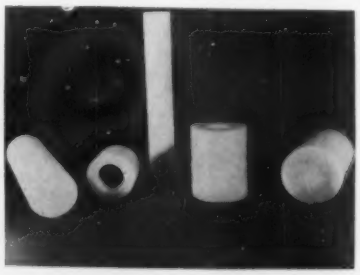


Clearance dimensions are machined and sides of jaws are chamfered on back faces to fit chucks with recessed jaws. The jaws can be bored in place for second operations or separately machined for special and odd shaped parts. They can be carburized and hardened after machining.

Gahr Machine Co., 19199 St. Clair Ave., Cleveland 19, Ohio. **Circle 408**

Polypropylene Plastic Cylinders, Rods

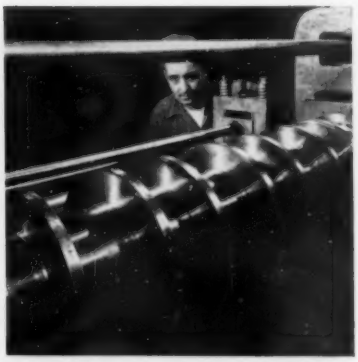
Heavy, semifinished polypropylene rods and cylinders are available for prototype applications as bearing material, pillow blocks, valves, laboratory



ware, appliance housings and automotive parts. The plastic is easily machined, ground, drilled, threaded and welded with standard tools and is suited for elevated-temperature and rigid construction service.

Cylinder stock is available in 4 and 6-inch OD x 2-inch ID. Rod diameters are from ½ through 3 inches.

American Agile Corp., 5461 Dunham Rd., Bedford, Ohio. **Circle 409**



Yoder Rotary Slitters reduce inventory... speed production

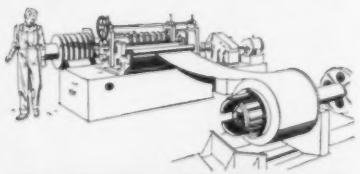
To help meet the demands of tight production schedules, YODER Slitters reduce mill-width stock quickly and economically to desired widths. If your needs are as low as 100 tons per month, time and manpower savings alone will offset the cost of your YODER Slitter in a matter of months, while reducing basic inventories. Compactly designed, standard YODER Slitters are built to handle standard coil widths... completely engineered lines for special requirements.

YODER accessories, such as coil cars, swivel unloaders, scrap choppers, scrap disposers, plate levelers and coil boxes, make stock handling fast and easy.

YODER also makes a complete line of Cold Roll-Forming equipment and Pipe and Tube Mills. To profit from YODER'S years of engineering and service experience, contact your local YODER representative or send for the YODER Slitter Manual.

Investigate the many advantages of YODER-engineered Slitter Installations. Write today for this comprehensive, 80 page YODER Slitter Manual... it's yours for the asking!

THE YODER COMPANY
5525 Walworth Avenue • Cleveland 1, Ohio



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● MANUFACTURERS OF RESINOID AND RUBBER BONDED WHEELS SERVING THE AIRCRAFT, CUTLERY AND STEEL FABRICATING INDUSTRIES.

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PEKAY ABRASIVES, INC.
271 GROVE AVE.
VERONA, N.J.

Use Reader Service Card, CIRCLE 93

Portable Tensile Tester

Model PT-20, a 20,000-lb capacity portable tensile-testing machine, permits hardness tests to be incorporated

in automatic production lines. Tensile load is applied by a manual hydraulic pump and the load is shown directly on the 8½-inch diam gage.

Steel City Testing Machines, Inc., 8817 Lyndon Ave., Detroit 38, Mich. **Circle 410**

USE READER SERVICE CARD ON PAGES 303 or 455 TO REQUEST ADDITIONAL TOOLS OF TODAY INFORMATION

Rotary Grinder Guide

Chamfering, deburring and other machine operations can be done accurately and quickly with a device equipped with

adjustable guides to allow pre-set depth of cut on both straight and curved edges in either air or electric rotary portable grinding operations. It can be equipped with a variation of guide design and cutters appropriate to the application.

A & S Production Tools, Inc., 17 Hermon St., Worcester 8, Mass. **Circle 411**

DIRECT READING TO .0002"

with full magnification from zero to infinity

MICRO-ALIGNMENT TELESCOPE

For precise alignment of all points at any distance; for establishing and checking straightness, parallelism and squareness; with full magnification of 32X or 45X, from zero to infinity.

The Micro-Alignment Telescope is the universal precision optical tooling unit for alignment of machine tools, textile and plastic machinery; for shipbuilding, missile launching, aircraft and missile assembly.

Optical micrometers read direct to .001" (standard) or .0002" (special). Right angle eyepiece and auto-reflection and auto-collimation accessories are available.

... *New*

Optical tooling publications: "Penta Prism Behavior" and "Precision Polygons" — a full treatment of the most important optical tooling accessories.

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431 SOUTH DEARBORN ST.
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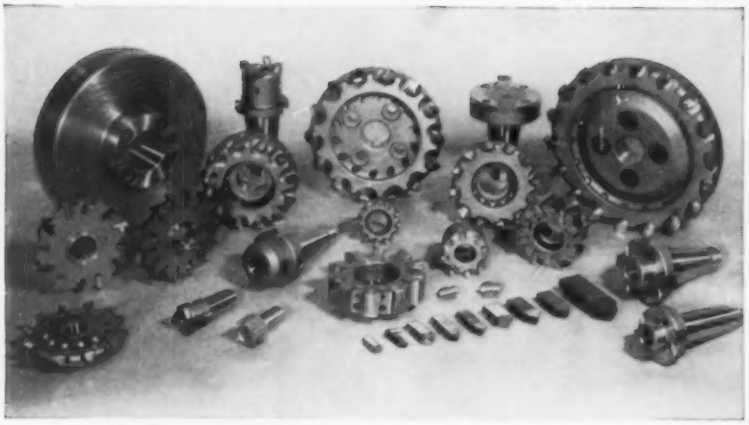


Milling Cutters — End Mills — Blades — Boring Tools — Arbors — Flywheels

These Lovejoy Products can help you Cut Costs!

The entire line of Lovejoy Milling Cutters and Accessories is designed to aid you in getting better production at less cost.

If you are not now using Lovejoy products, we invite you to do so at first opportunity.

Lovejoy precision-engineered tools include:

Inserted-tooth milling cutters (face, side, end, slotting and boring) which feature husky, forged steel housings; exclusive Lovejoy "positive-locking" blade assembly; a variety of dozens of models and hundreds of sizes.

Blades: H.S.S., Vasco Supreme and carbide. These are interchangeable over a wide range of housing sizes, and Type "A" face milling blades will fit any standard Lovejoy Type "A" cutter of 4½" to 24" dia. All Lovejoy blades are carried in stock, ready for immediate shipment. Special cutters are a Lovejoy specialty.

The New JOYDEX is a real performer!

Among the startling production reports coming in is a motor frame, rough-milled at 26 cubic inches per minute by an 8" diameter JOYDEX. Finish (with sweep blade) was 63 micro inches. Material was 115 Brinnell boiler plate.

Indexable throw-away blades, plus performance like the above, make the JOYDEX a joy to use—for operator, manager and treasurer. May we send you our latest spec sheet?

Catalogs — include: "Face Mill Catalog No. 31; Side Mill Catalog No. 32; Type "S" Bulletin; Arbor Catalog No. 33; "Speed and Feed" Calculator. Write today for copies desired.

LOVEJOY TOOL COMPANY, INC.
Springfield, Vermont, U.S.A.

Use Reader Service Card, CIRCLE 95

TOOLS of today

Automatic Transfer Press

Clamp capacity of 25 tons and transfer capacity of 5½ tons, with comparable strokes of 5 and 2½ (maximum) inches, are specifications of this air-operated transfer molding press. Model 725 is for use on short production runs

where low mold costs and quick setup are desired. It can be converted to compression molding and controls can be operated either continuously, on a fully automatic basis, or intermittently, on a manual or semiautomatic basis. The press will handle molds up to a maximum size of 11 x 6 inches.

Plastics Molding Equipment Div., F. J. Stokes Corp., 5500 Tabor Rd., Philadelphia 20, Pa. **Circle 412**

Data Collector

A self-contained device, about the size of a typewriter, collects and records, in computer-intelligible form, all the necessary data for use by computers to efficiently process such items as payroll, work-in-process inventory, costs and

scheduling operations. The equipment either eliminates entirely or substantially reduces clerical labor presently required to collect and record this type of data.

The Model 180 collector assembles data from pre-punched IBM cards. Output data is recorded at the rate of 15 characters per second on 5, 6, 7 or 8-level punched paper tape. Output tapes are automatically processed by any standard central computer.

Control Data Corp., 501 Park Ave., Minneapolis 15, Minn. **Circle 413**

USE READER SERVICE CARD ON PAGES 303 or 455 TO REQUEST ADDITIONAL TOOLS OF TODAY INFORMATION

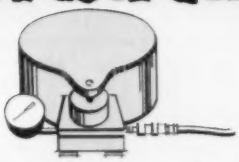
Ceramic Tooling Material

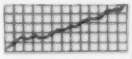
Precision soldering of a range of components such as diodes, rectifiers and electrical connectors can be done with tooling made from a high-temperature ceramic, M120F-T. The material

has heat resistance to 1100 C and will not oxidize or spall in the soldering range. Low thermal expansion rate permits assembly tolerances of microthousandths of an inch over thousands of cycles. Hardness of the ceramic is comparable to tool steel, making it usable in operations such as irons, flame setups, radiant heat or induction soldering. Sizes range from 10 x 10-inch boats to small inserts of 0.062-inch diam. Tolerances of ± 0.001 inch can be held.

Duramic Products, Inc., 426 Commercial Ave., Palisades Park, N. J. **Circle 414**

LOOK SIR,
it's automatic
and continuous.



The Barry Serva-Levl Mount automatically maintains level of precision machinery within 0.0005 inch at all times. It isolates vibration, reduces misalignments and rejects, increases  production, and -- if you have to move --, no holes to drill, no special foundation, no shimming. The Serva-Levl Mount makes any machine movable.

P.S. They come in 3 sizes.

WRITE FOR BULLETIN NO. 60-05.

SEE IT LEVEL A SURFACE PLATE AT BOOTH 1420, ASTE SHOW.

BARRY CONTROLS INCORPORATED

700 Pleasant Street
Watertown 72, Mass.

1400 Flower Street
Glendale, California

Use Reader Service Card, CIRCLE 96

Pin Type Gages

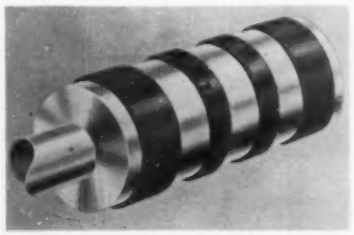
Precision controlled, stabilized and heat treated to R_C 63-65, a line of pin type gages is made from oil-hardened tool steel. Tht pins are ground in sizes of from 0.030 to 0.750 inch, in increments of 0.001 inch with a tolerance of ±0.00005 inch. Pins can be reversed when worn.

Dundick Tool Works, Inc., 3410 W. 31st St., Chicago 23, Ill. **Circle 415**

Filled Teflon Piston Rings

Nonlubricated service, to seal reciprocating, oscillating and rotary motion of both external and internal cylindrical surfaces against the leakage of liquids or gases, is provided by these carbon filled Teflon piston rings. Matched rider rings are used where long stroke or heavy pistons make additional support necessary.

The abrasion-resistant, thermally stable piston rings can be used in a temperature range of from –420 to 500 F, and in applications where lubrication is impossible, undesirable or impractical; in process industries where corrosion and product contamination are important factors; in processes involving

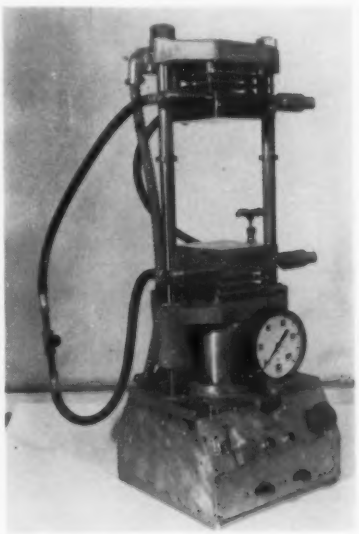


gases, solvents and nonlubricating liquids; and under heavy loads and low velocities where an oil film cannot be maintained. The carbon-filled Teflon rings are furnished in butt joint, step joint, scarf cut or solid designs.

The Garlock Packing Co., 444 Main St., Palmyra, N. Y. **Circle 416**

Molding Press

Short-run production of small, difficult parts, where control is an important factor in the process, can be accomplished with this molding press. It is also useful in development laboratory use. Press size is 10 x 10 x 5 inches.



Platens with heating coils, thermometer and water cooling chamber are 4 x 4 inches. The top platen is stationary and the lower platen is moveable by a 3 11/16-inch diam cylinder and rubber bellows. The press operates from 5 lb to maximum line pressure. Lower platen travel and opening between platens is 7½ inches. The unit will take a mold up to 4 inches in diameter.

Tooling Service Co., 10307 Detroit Ave., Cleveland 2, Ohio. **Circle 417**

MEASURE TO 0.0001" IN 3 DIMENSIONS WITH UNITRON'S TOOLMAKERS MEASURING AND METALLURGICAL MICROSCOPE

The UNITRON Model TM is more than just a measuring microscope. It is the only instrument which combines in one stand a completely equipped toolmakers microscope for precise measurements — LENGTH, WIDTH and DEPTH, and a metallurgical microscope for examining the structure of polished metal samples under high magnification.

NOTE THESE QUALITY OPTICAL & MECHANICAL FEATURES

- **Objectives:** achromatic, coated, 3X, M10X, M40X. **Eyepiece:** coated Ke10X with crosshair.
- **Magnifications:** 30X, 100X, 400X; up to 2000X with accessories.
- **Focusing:** Both dual control rack and pinion coarse and micrometer-screw type fine adjustments. Body has locking device.
- **Three Illuminators:** sub-stage, surface and vertical, have variable intensity.
- **Combination Stage:** rectangular ball bearing with linear measurements to 0.0001" and rotary measurements to 5' with vernier. (Metric model available on special order.)
- **Depth Indicator:** measures in units of 0.0001" by "optical contact" with specimen.
- **Projection Screen:** available as accessory for optical comparison.
- **Eyepiece Turret:** available as accessory for measuring surfaces, radii, thread pitch etc.

In fitted hardwood cabinet

$1050 FOB Boston

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INSTRUMENT DIVISION of UNITED SCIENTIFIC CO.
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Hand Tapping Machine

The overarm of this machine for hand tapping is instantly adjustable vertically from minimum to maximum height. The articulated spindle arm allows access to all areas of the work table and to areas off the table at the back of the machine.

The tapping spindle assembly allows linear and rotary movement, counter balanced by spring loading. This gives a sensitive feel when using small, fragile taps and reduces thread lead distortion. Tapping range is from No. 8 to ¾-inch standard and ⅛ to ½-inch pipe taps held in 1-inch diam individual tap holders.

The Producto Machine Co., 990 Housatonic Ave., Bridgeport 1, Conn. **Circle 418**

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Shielded-Arc Welder

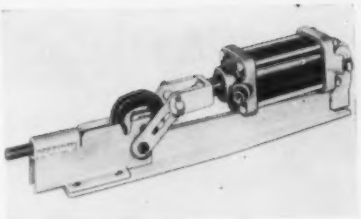
Designed for precision welding applications, the VTW-14 can be used with any inert-gas, shielded-arc welding head. The welder can be used manually or in automatic machines to weld thin metal parts, stainless steel tubing, electron tube components or instrument parts. It will handle both ferrous and non-ferrous alloys from approximately 0.001 to 0.025 inch in thickness.

A continuously adjustable welding current range varies from 0.25 to 25 amp. A choice of methods for starting the arc is provided.

Vacuum Tube Products Div., Hughes Aircraft Co., Florence Ave. & Teale St., Culver City, Calif. **Circle 419**

Workholding Clamps

Swivel base, hand operated clamps have 90-deg handle motion which locks the plunger for push or pull motion without resetting the reversible handle. The plunger is guided by two widely separated, hardened steel bushings for accuracy in motion and minimum wear. Built-in deflection provides uniformly tight clamping of parts with normal variation in thickness. Model AOP&P-1200, illustrated, is air or oil operated and produces approximately 4½ times the clamping force with 85 psi than the



cylinder would alone. Power failure does not permit reverse motion of the plunger nor affect clamping force.

Lapeer Mfg. Co., 1140 W. Baltimore, Detroit 2, Mich. **Circle 420**

The BOYAR-SCHULTZ 6x18 Challenger

PREFERRED by those who demand the Ultimate in PRECISION... STABILITY ...QUALITY and ECONOMY

Modern design, finest materials, skilled workmanship with closest attention to detail form the basis for the extreme accuracy and cost cutting ability of this Boyar-Schultz 6-18 Challenger Surface Grinder.

Compare it with any other selling for 50% more.

Boyar-Schultz CORPORATION
2004 South 25th Avenue • Broadview, Illinois

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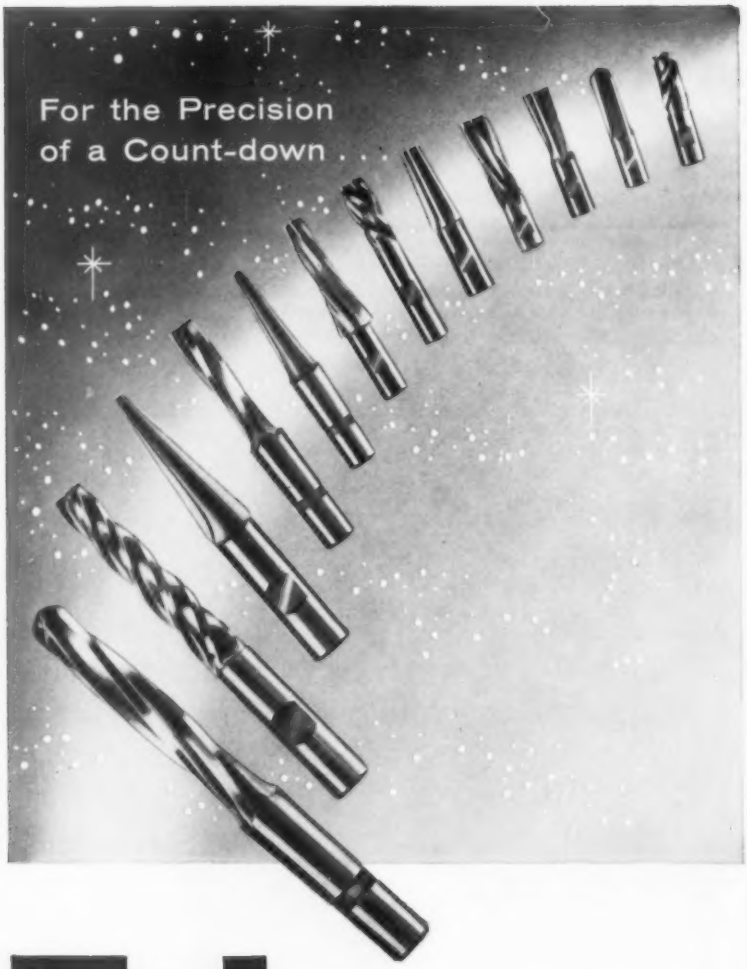


T-J LAUNCHES A NEW

CUTTING TOOL LINE

FOR MILLING ACCURACY

For precision milling to close tolerances, so vital in today's high-speed, high-production manufacturing, T-J now offers a new, improved line of milling cutters. The new cutter line features a high helix angle, double back-off, and a right-hand spiral to produce more and smoother cuts between grinds, and a free-cutting, stronger tool.

Specially designed and precision-manufactured for die sinking and production milling, the new line is designed to include flats on the shanks for set screw type drivers on all of the end and side milling cutters. Write today for complete information to the Tomkins-Johnson Company, Jackson, Mich.

Ask for completely new cutter catalogue No. 259.

T-J TOMKINS-JOHNSON

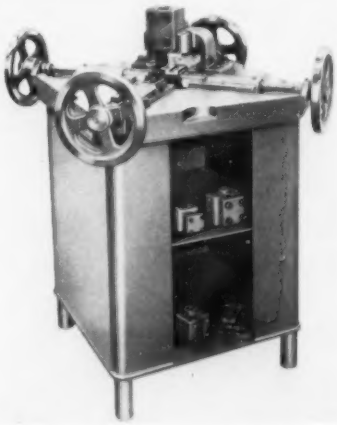
RIVETERS . . . AIR AND HYDRAULIC CYLINDERS . . . CUTTERS . . . CLINCHERS

Use Reader Service Card, CIRCLE 99

TOOLS of today

Tool Tester

Design and building of tooling for seven models of the company's 4-slide machines can be done with the No. 00-2 tool tryout fixture. It permits testing and sample marking without stopping production.

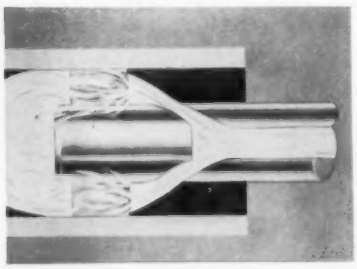


The fixture is supplied with a No. 1 4-slide post and holder for tryout of No. 1 and No. S-1-F 4-slides. Forming slides with tool holder adapters for No. 0 through S-2-F are included. Other adapters are available.

A. H. Nilson Machine Co., 1000 Bridgeport Ave., Shelton, Conn. **Circle 421**

Boring Bars

Liquid-cooled bars for adjustable boring and reaming cutters are available with straight or Morse taper shanks in a full range of sizes.



Passages in the Polar Bar toolholders deliver streams of coolant directly to each of the two cutting edges, flushing away chips and preventing heat build-up. Use of the bars provides long tool life, high cutting speeds and accurate work.

Muskegon Tool Industries, Inc., Muskegon, Mich. **Circle 422**

Multiple-Spindle Heads

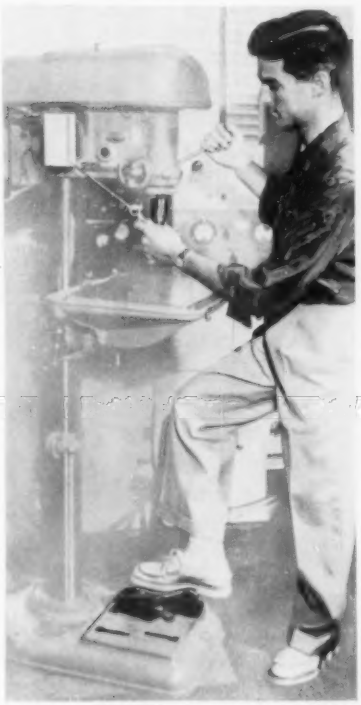
Universal joint multiple-spindle drilling and tapping heads are adjustable and provide rigidity, flexibility and versatility. The heads are made of heat treated, lightweight, aluminum alloy castings, heavily ribbed for maximum strength. Gears and spindles are made of high-alloy heat-treated steel. All spindles run in ball bearings with more than the required thrust load capacities.

Jarvis Corp., Middletown, Conn. **Circle 423**

USE READER SERVICE CARD ON PAGES 303 or 455 TO REQUEST ADDITIONAL TOOLS OF TODAY INFORMATION

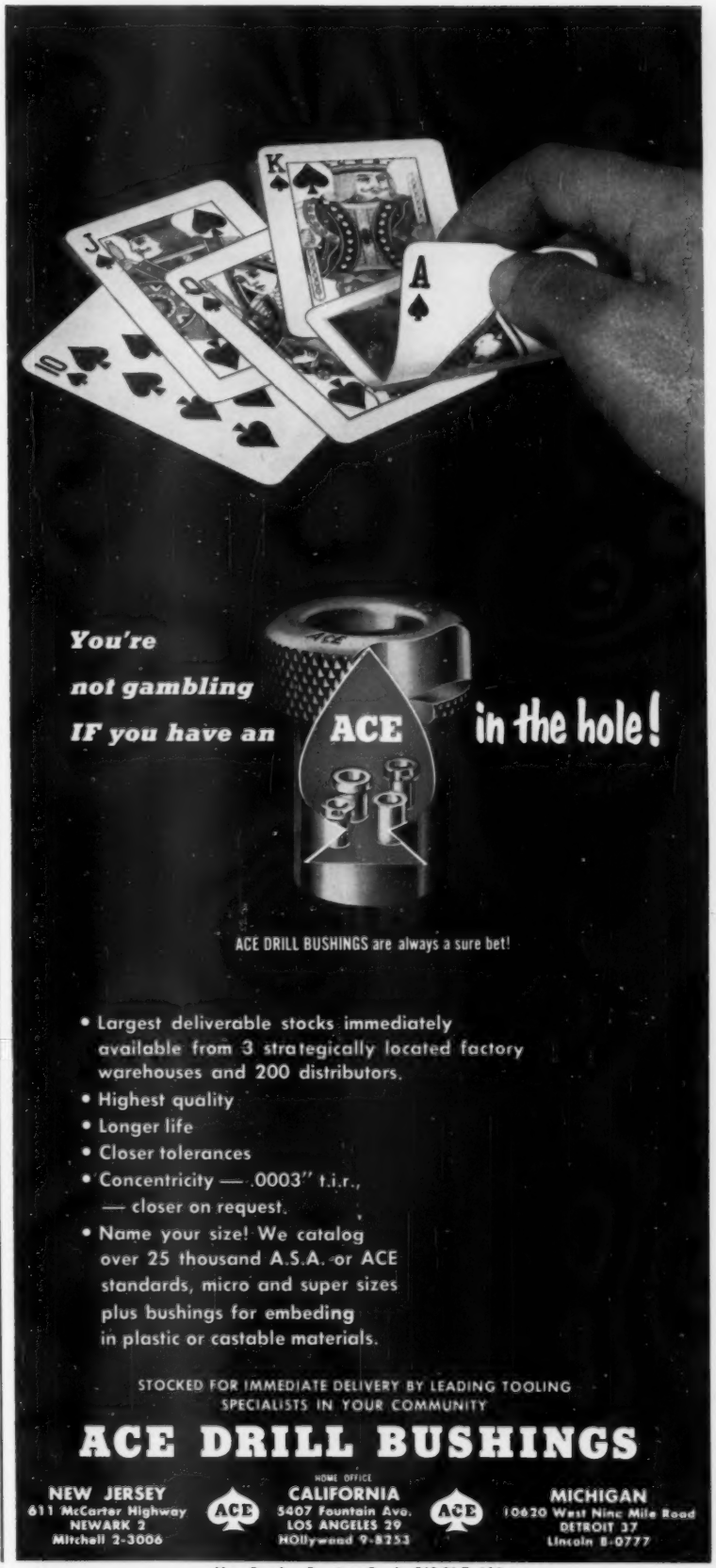
Safety Switch

Damage to machines and injuries to their operators can be avoided through use of a safety device which can be attached to any machine utilizing a key-operated chuck. Protection is provided during make-ready by locking off the flow of electric current while the chuck key is in use.



The key is permanently attached to a spring-wound cable on a drum. Pulling the key out for use trips a switch which shuts off the current. Retraction of the cable reactivates the current. The switch is easily and quickly installed in any convenient location.

H B Research & Development Co., 11719¼ E. Washington Blvd., Whittier, Calif. **Circle 424**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ACE DRILL BUSHINGS are always a sure bet!
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• Name your size! We catalog over 25 thousand A.S.A. or ACE standards, micro and super sizes plus bushings for embeding in plastic or castable materials.
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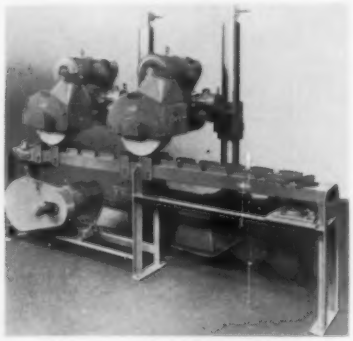
MICHIGAN
10620 West Nine Mile Road
DETROIT 37
Lincoln 8-0777
Use Reader Service Card, CIRCLE 100

Buffing and Polishing Machine

Straight-line buffing and polishing in high-production, light-duty operations can be done with this machine. Adjustable lathes can be positioned around the unit for tangent or wide-wheel, cross-cut buffing. Abrasive belt arms and polishing heads can be attached for strapping and contact wheel-polishing in deburring and blend operations.

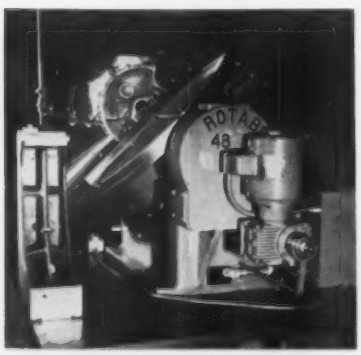


The conveyor unit, to which sections can be added, is 10 inches wide and 8 ft long. The chain type drive has individual platens that carry workholding fixtures. Variable conveyor speed drives are from 10 to 30 fpm.

Acme Mfg. Co., 1400 E. Nine Mile Rd., Detroit 20, Mich. **Circle 425**

Rotary Positioning Table

Pendant-controlled, motor-powered tilting and rotation provide fast, easy, accurate positioning in this rotary table.

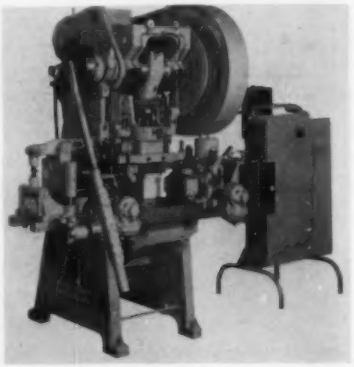


The unit gives 360-deg radial and 90-deg angular positioning, microscopically accurate within five sec of true position, and repeatability of settings within one sec of arc. Faceplate sizes are 12 to 84 inches.

Machine Products Corp., 6771 E. McNichols Rd., Detroit 12, Mich. **Circle 426**

Roll Feed

This rack-and-pinion roll feed, shown mounted on an OBI inclinable press, is equipped with disk type brakes for accurate feeding at high speeds. The feed



is also equipped with a running micro-adjustment that permits adjusting the feed length plus or minus ⅛ inch while the press is running at full speed.

F. H. Littell Machine Co., 4101 Ravenswood Ave., Chicago 13, Ill. **Circle 427**

USE READER SERVICE CARD ON PAGES 303 or 455 TO REQUEST ADDITIONAL TOOLS OF TODAY INFORMATION

Induction Heater

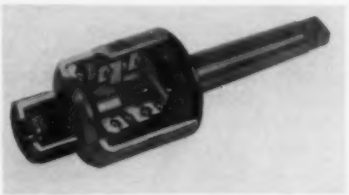
Selective hardening, tempering and annealing of tool steel parts, and other heating and bonding operations can be done with this 30 kw high-speed induction heating unit. Pushbutton controls assure exact surface heating patterns without distortion, decarburization or

excessive oxidation. Capacities of 5, 10, 20, 30 and 60 kw have 3-phase 60-cycle power supply. Accessories can be supplied.

C. I. Hayes, Inc., Wellington Ave., Cranston 10, R. I. **Circle 428**

Floating Toolholder

Function of this toolholder is like that of a deep grooved ball thrust race. It permits frictionless movement in any radial direction but prevents rotary motion. In this tool, the flat ball races for

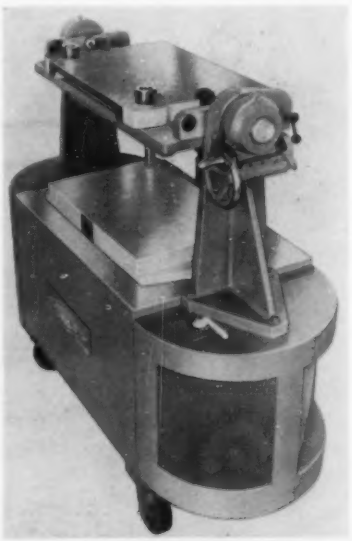


end thrust have been replaced by two grooved races. Because the balls fit the race grooves, high static and impact loads may be applied without damage.

Munn Engineering Co., 24729 Sherwood Ave., Centerline, Mich. **Circle 429**

Die Assembler

Primarily designed for pulling apart upper and lower die assemblies, the Model 1 portable die assembler simplifies aligning of punches to dies and mating of die components during the initial stages of die manufacturing, and speeds



repair work. The lift table and upper platen are arranged for fast clamping and unclamping. The hydraulically actuated table develops a 3000-lb closing force and 1500-lb separation force, providing impressions on punches or dies for final machining. Table movement is valve controlled and varies from 0.0 to 30 ipm. The unit has a battery-driven motor and self-contained charging unit.

The Producto Machine Co., 990 Housatonic Ave., Bridgeport, Conn. **Circle 430**

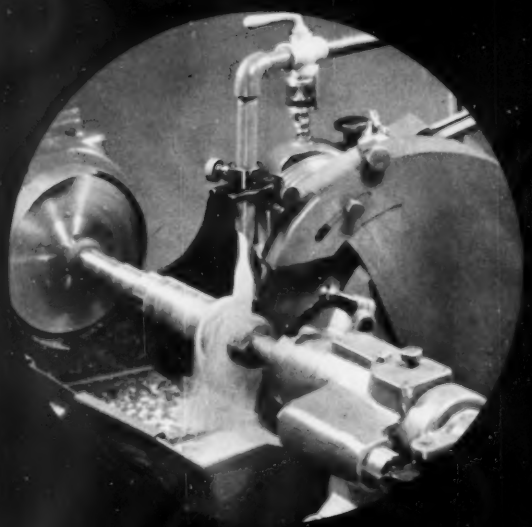
(Continued on page 269)

This is

Stuart's

new
HI-D
at work

This is what **HI-D** is . . .



A new *transparent* metalworking compound a *petrochemical* compound possessing the high detergency of synthetics but none of their disadvantages. Often described as a hybrid—Hi D is not truly an emulsion, and not anything like a straight chemical compound. Turn the page to see how this new type of cutting fluid can help you

This is what

Stuart's

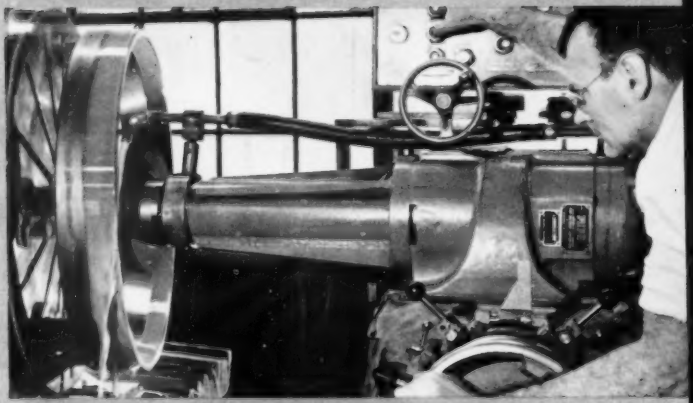
new **HI-D** will do...

Keep grinding wheels open and free-cutting. Permit standardization of wheels—do more different jobs with fewer wheels. Minimize machine tool maintenance. Aid chip formation to produce fine surface finishes. Lubricate efficiently as it cleans. Remain effective and stable at 60:1 for grinding and at 40:1 for cutting—even after picking up tramp oil. Settle chips quickly in an ordinary sump—produce controlled foam in a flotation-type filtering system. Inhibit rust, even at mixtures greater than 60:1.

This is how

Stuart's

new **HI-D** has helped others...



LaSalle Steel Company reduced cutting fluid costs by 45%, using Hi-D for everything from ¼" roughing cuts on lathes to fine finish grinding. At 50:1, Hi-D stops in-plant rust on highly finished steel bar stock.

The Torrington Company, Bantam Bearing Division, saves ⅓ on lubricant costs by using Hi-D at 60:1 on 87 grinders. Hi-D trims *hidden costs,* too, because Torrington dresses wheels only ⅓ as often as before. Think of the savings in wheel and diamond life. Direct costs are slashed on some jobs because both rough- and finish-grinding are done with the same wheel. As for finish, Hi-D eliminates 95% of chip "feedback" from the filtering system.

Stuart's **HI-D** replaces five cutting fluids in diversified plant

Here's how Hi-D's combination of detergency and lubricity slashes lubrication costs for one company on 20 different jobs that range from sawing to surface grinding:

1. **Sawing**—Elimination of chip welding improves blade life. Ability to perform at 10:1 (5:1 formerly required) reduces carry-off and waste.
2. **Turning**—Production is increased by stepping up feed from .030 to .060 ipm. Depth of cut is increased from ⅛" to ¼".
3. **Mills**—Rancidity is eliminated.
4. **Surface grinding**—Wheel life is increased, downtime is decreased, because petrochemical compound Hi-D keeps wheels open and free-cutting.

On every application, Hi-D matches or betters the performance of five compounds replaced. Cutting fluid inventory and handling costs are reduced. Using Hi-D in the toolroom and cutoff department (serviced by a central system) saves 50 to 60 gallons of cutting fluid per week.

The way to evaluate potential savings in *your* plant is to test Stuart's new Hi-D on a variety of operations. Or, send for free test samples of Hi-D in both concentrate and mixture form that will demonstrate its transparency, lubricity, and stability. Phone your Stuart representative or the factory—BIshop 7-7100.

FREE SAMPLE

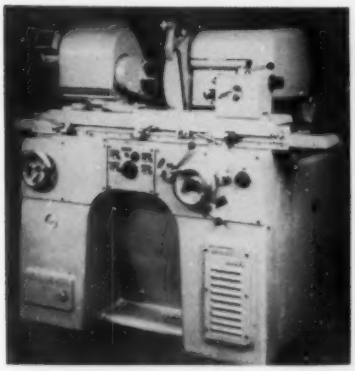
Stuart

D. A. STUART OIL CO., LIMITED
2727 South Troy Street, Chicago 23, Illinois

CANADIAN D. A. STUART OIL CO., LTD.
P.O. Box 430, 43 Upton Road, Scarborough, Ontario, Canada

Cylindrical Grinder

Model R4-300P/Y is a high precision, fully automatic machine that can be preset to grind within 50 millionths of an inch to a positive stop. It does not require in-process gaging of any kind.



The two-ton grinder drives a 16-inch wheel with a 4-hp motor. The eight-speed headstock is automatically braked.

Olivetti Corporation of America, Machine Tool Div., 42-33 Northern Blvd., Long Island City 1, N. Y. **Circle 431**

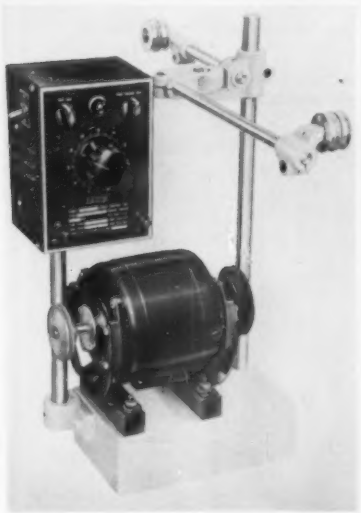
Vertical Drilling Machine

Infinitely adjustable hydraulic feed control, combined with air feed, assures steady feed on interrupted cuts or break-through with this No. 3 machine. Drilling capacity is 3/16 to 5/8 inch in alloy steel. Work table is automatically air-positioned for fast tool or fixture change. Spindle speeds are from 300 to 1800 rpm, with eight speed changes in each of two ranges. Built-in solenoid units synchronize clamping and indexing fixtures with spindle cycle.

Snow Mfg. Co., 435 Eastern Ave., Bellwood, Ill. **Circle 432**

Variable Speed Motor

Jeweler type lathes are powered by this variable speed motor which provides a continuously variable spindle speed from 0 to 4000 rpm. Features of the tubeless unit are dynamic braking, reversing and separate switches for coolant pump control, and a foot-operated stop-start switch.



The 1/8-hp double ended motor operates on 110-volt, 60-cycle, one-phase a-c current.

Louis Levin & Son, Inc., Los Angeles 7, Calif. **Circle 433**

Precision Drive Motors

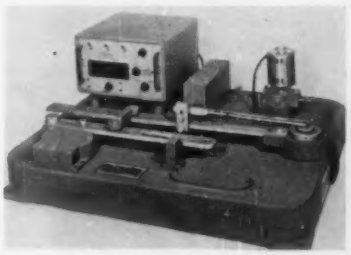
Custom-built motors in Nema frame sizes are designed for applications where precision drive is necessary. The motors are balanced to 25 millionths amplitude of vibration. Maximum shaft runout is 50 millionths of an inch.

The motors are available in 1 to 20 hp with speeds from 900 to 3600 rpm and with straight or tapered noses. Permanently preloaded double row cylindrical roller bearings with tapered bores are mounted at the shaft extension end of the one-piece integral casting that forms the motor housing and base. The rear housing for the bearings locates permanently preloaded angular contact bearings close to the rotor. This housing, extra large shaft and bearings provide extreme rigidity.

Pope Machinery Corp., 261 River St., Haverhill, Mass. **Circle 434**

Torque-Wrench Calibrator

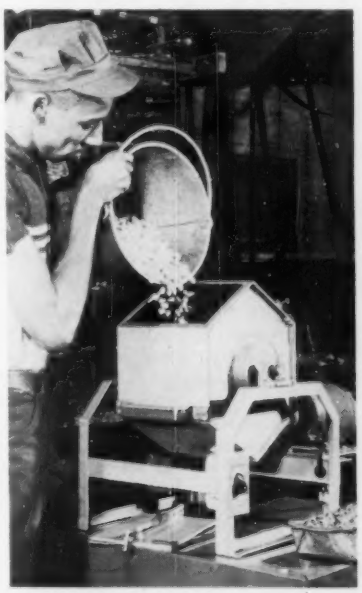
Designed to rapidly load and read out the actual break-away value of torque wrenches of any design, this Model TWC-139 calibrator uses a conventional proving ring as a load measuring standard. Operation is automatic with most wrench designs. Accuracy is 0.4 percent of full scale. The instrument can calibrate wrenches with capacities from 20 in-lb to 2000 ft-lb. Manual operation in checking dial or clock type wrenches does not impair accuracy.



Steel City Testing Machines, Inc., 8817 Lyndon Ave., Detroit 38, Mich. **Circle 435**

Barrel Finishing Machine

Deburring, radiusing and finishing of small parts can be done with this portable tumbling machine that can be used with all conventional tumbling media and compounds. It is loaded, set for time, actuated and unloaded by the operator. The 13 x 8-inch drum operates at 18 to 28 rpm.



Chicago Wheel & Mfg. Co., 1101 W. Monroe St., Chicago 7, Ill. **Circle 436**

Dial Groove Gages

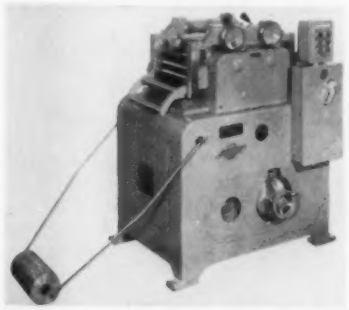
Internal grooves from 0.080 to 0.350 inches deep can be measured with a series of dial gages which have a lever action and easily read indicators that provide readings from 0.2 to 1.6 inches without removing the work from the machine and without use of a micrometer. The gages have a range of location depths of from 15/16 to 2⅜ inches. Grooves from 0.080 inch deep on the

smallest gage to 0.350 inch deep on the largest gage can be measured.

Maxwell Industries, Inc., 493 E. 5th St., Ashtabula, Ohio. **Circle 437**

Straightening Machine

Roll hydraulic variable-speed straightening machine is normally used for straightening thin stock or for producing very flat stock in heavier materials. It can also be used to straighten parts that have been previously blanked



out in punch press operations. Speed is from 0 to 72 fpm.

F. H. Littell Machine Co., 4101 Ravenswood Ave., Chicago 13, Ill. **Circle 438**

USE READER SERVICE CARD ON PAGES 303 or 455 TO REQUEST ADDITIONAL TOOLS OF TODAY INFORMATION

Plate Beveler

Model X-8 beveler cuts a ½-inch bevel on mild steel plate (or ⅜-inch in stainless) to prepare the seam for arc weld fillet. On plate up to one inch thick, both sides can be beveled by turning the plate.

Although designed for use on small hand-carried pieces, larger pieces can be beveled through use of a support table in front of the machine. Cutting speed with mild steel is approximately 11 fpm. The machine is available in three models to cut 30, 37½ or 45-deg bevels.

American Pullmax Co., Inc., 2455 N. Sheffield Ave., Chicago 14, Ill. **Circle 439**

deep holes... perfect holes... with S&E solid carbide Bushings*

THE BORE
Super precision ground and lapped to a jewel finish— concentric —to exact tolerance.

THE BUSHING
Rigid—Solid Carbide support for tool-control and long tool life.

THE BODY
Solid Carbide bearing the full length of the bore for long run bushing accuracy.

S&E Bushings Cost Less With long accurate bushing life (in excess of 50 times that of steel bushings), they cut down-time to the minimum and boost production to the maximum. The result is lower bushing costs, reduced inspection time, less scrap and lower tool inventory.

S&E Bushings Perform Best Extremely accurate work can be obtained with the use of these bushings, particularly where precise size and hole location are of paramount importance, or where rigid support and alignment must be maintained. For gun drilling, they are considered a must . . . they hold the bore size longer . . . they make the tool work better.

* Standard S&E bushings meet all A.S.A. standards. They are also available in all classes of (A.G.D.) gagemakers tolerances. Special and unusual type carbide bushings are regularly fabricated by S&E.

Complete catalog of S&E products available on request.

S&E MACHINE PRODUCTS INC.
Bridgeport, Michigan

Sales offices in all principal cities.

Use Reader Service Card, CIRCLE 105

Solid Carbide Bushings

Rigid support and alignment, provided by a line of solid carbide bushings, improves cutting tool performance, extends tool life and cuts inspection time, downtime and scrap. The bushings are particularly designed for gun drilling applications, which require a maximum of 0.0002-inch clearance. The carbide units are fabricated to exact clearance requirements and hold true to size up to 50 times longer than steel bushings.

S&E Machine Products, Inc., Bridgeport, Mich. **Circle 440**

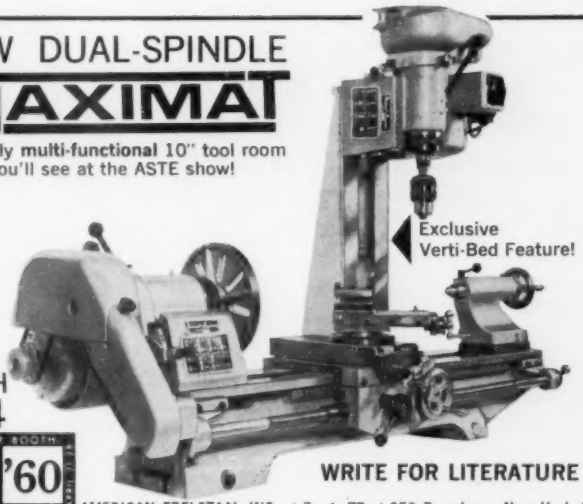
Two-Axis Numerical Control

Turning, boring and grinding contouring machine tools are numerically controlled in increments of 0.000025-inch—a command value of 40,000 pulses per inch of slide travel—with this punched tape control unit. This permits machining to a tolerance of 0.0001 inch in routine reproduction of templates and machining to a tolerance of 0.0002 inch in contour boring and turning operations.

Tape can be read at a rate of 300 lines per second in the forward direction and 600 lines per second in the reverse direction. Automatic rewind permits the operator to remove the part as tape is being rewound. Auxiliary controls for coolant flow, spindle speed and automatic grinding wheel dressing operations are optional. A feed rate override permits reduction down tc as little as 20 percent of programmed feed rate. Variables can be controlled without remaking the tape to provide reduced tool loading in critical areas.

Bendix Industrial Controls Section, Bendix Aviation Corp., 21820 Wyoming Ave., Detroit 37, Mich. **Circle 441**

NEW DUAL-SPINDLE
MAXIMAT
The only multi-functional 10" tool room lathe you'll see at the ASTE show!



BOOTH
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'60
WRITE FOR LITERATURE
AMERICAN EDELSTAAL INC. / Dept. TD / 350 Broadway, New York 13, N.Y.

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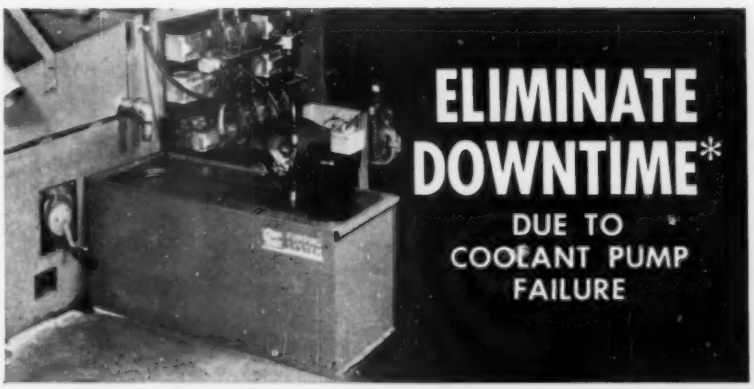

GRAYMILLS
SUPERFLO COOLANT
PUMPING SYSTEMS

*Installed in a matter of minutes, GRAYMILLS Coolant Pump and Tank Units eliminate production downtime by being ready to go when built-in units fail. GRAYMILLS Pumping Systems are easy to clean, can be used with liquids bearing abrasives and will handle any type coolant or cutting oil. Available with centrifugal or gear type pumps, 1/25 to 1/2 HP, in tank capacities of 2 to 128 gals.

Every plant needs one or more reserve GRAYMILLS Pumping Units as insurance against production downtime. Get yours today! They're sold by leading Industrial Distributors everywhere.

Write for Complete Catalog No. 56R

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3703 N. LINCOLN AVE. • CHICAGO 13, ILLINOIS
DESIGNED AND PRICED FOR MACHINE BUILDERS USE

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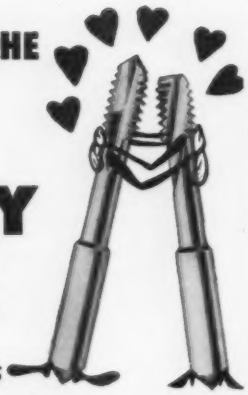
THE INSIDE STORY BEHIND THE "NECKING" OF THE NEW JARVIS STUBBY



NEW STUB SCREW MACHINE TAPS FOR BAR AUTOMATICS SAVE TIME, ELIMINATE ALTERATIONS!

HIGH SPEED STEEL — GROUND THREADS

Three Styles Available

Spiral Flute Bottoming #SF-01	Spiral Point Plug #SP-50	Spiral Point Bottoming #SP-70

WHY STUBBY?

Jarvis Stubby, a new screw machine stub tap developed for production tapping on bar automatics, is designed to cut costs by eliminating down time and improving performance.

SECRET OF STUBBY'S "NECKING"

The area directly behind Stubby's threads has been necked down to below the root diameter. This "necking" creates *more chip room . . . reduces drag . . . facilitates application of cutting oils or coolants* to the cutting edges for *longer tap life.*

STUBBY IS STRONGER

Its *short threaded section* and *shorter overall length* make Stubby a much *stronger* tap. You use standard size bushings (eliminating the need for special drills when making tap holders), because Stubby's shank is ground to standard fractional dimensions. Depth of thread is not a problem; for the combination of length of thread and length of necked shank is equal to the thread length on equivalent standard taps.

STUBBY BEATS COSTS — CUTS DOWN TIME

With Stubby you no longer need to alter standard taps for short clearance jobs. This means you cut costly machine down time, operator's time and minimize the possibility of having inconsistent tap performance.

STUBBY AVAILABLE FROM STOCK!

Stubby *is available from stock* in Spiral Flute Bottoming #SF-01, Spiral Point Plug #SP-50, and Bottoming Spiral Point #SP-70. All 3 styles available in machine screw sizes #2 thru #10. Other sizes available on request. WRITE FOR STUBBY LITERATURE AND TAP CATALOG.

OTHER JARVIS TAPS AVAILABLE:

- HAND TAPS
- MACHINE SCREW TAPS
- PIPE TAPS
- NUT TAPS
- TAPPER TAPS
- PULLEY TAPS
- ALL TYPES OF SPECIALS

Jarvis CORPORATION
NORTH ATTLEBORO, MASS.

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☐ Send Rep. ☐ Send Stubby lit.
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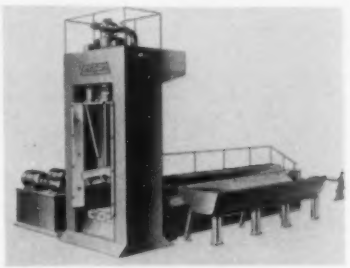
Continuous-Feed Scrap Shear

Available for purchase, lease or for toll operations by the distributor's personnel, this Verson 1200-ton scrap shear



has a continuous conveyor system that permits fast production on heavy industrial scrap, cutting to lengths in multiples of 6 inches to 5 ft or more without prior cutting.

M. S. Kaplan Co., 231 S. LaSalle S., Chicago 4, Ill. **Circle 442**

Adjustable Drafting Table

Designed for use with present office desks or tables, the Desk-O-Matic adjustable drafting table has a flat drawing surface adjustable from 29 to 38 inches in height. Height and top tilt adjustments are counterbalancing. The

top can be tilted from horizontal to a vertical angle of 90 deg. All adjustments are made by the operator from the front of the table.

The Basswood steel-edged tops are available in two sizes, 37½ x 54 inches and 37½ x 60 inches. Two 2½-inch pencil troughs are at table edges. Desks can be placed at either side of the table.

Mayline Co., Inc., Sheboygan, Wis. **Circle 443**

Gaertner Toolmakers' Microscope used to measure typical piece part. Co-ordinate range 4" x 2".

Precise measurement to 0.0001" and 1 min. of arc

Gaertner Toolmakers' Microscope

Here is a reliable, easy-to-use microscope for precise measurement of piece parts, tools, dies, thread gages, templates, jigs, fixtures, etc. Ideally suited for making a wide variety of precision measurements and is especially valuable in reducing rejects in production work.

With the Gaertner Toolmakers' Microscope you make direct, non-destructive measurements — no contact, no distortion, images are sharp and clear. It is a basic measuring instrument for inspection depts., gage labs, tool and die and model shops, industrial and research labs.

The Gaertner Toolmakers' Microscope has been proven in use by U. S. Government Gage Laboratories, and by prime contractors and their subcontractors. With all parties using the same measuring instrument, inspection procedures are co-ordinated and disagreements and rejects minimized.

Features that help you get
HIGH SETTING AND REPEATING ACCURACY

- Low, compact built-in rotary stage reads to 1 minute of arc throughout 360° range.
- Minimum overhang of stages.
- Full 2" precision-lapped lead screws with correction device.
- Straightforward, direct, uncomplicated optical system.

Features that assure you of
EASY, CONVENIENT OPERATION

- Independently rotatable cross hairs in protractor ocular speed up measurements, simplify measuring procedure.
- Convenient location of ocular eyepieces for ease of reading.
- Built-in transformer and plugs for all illuminators.

Modifications and accessories to
MEET YOUR EXACT REQUIREMENTS

- Thread and radius templates, camera and spotting attachments, fine motion focus, variable magnification available.
- If you have a special measuring problem, our staff of representatives will be happy to consult with you. The service and engineering facilities of the manufacturer are always immediately available to help you.

On display at ASTE Tool Show, Detroit Armory, Booth 845, April 21-28

Designed and manufactured by

The Gaertner Scientific Corporation

1241 Wrightwood Ave., Chicago 14, Ill.
Telephone: BUckingham 1-5335
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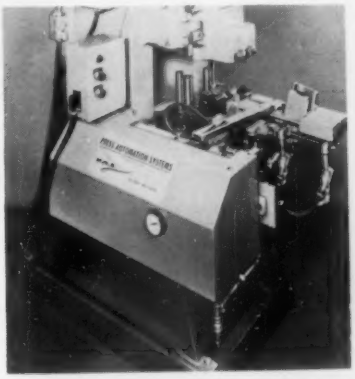
Press Feeder Unit

Production of small stampings is increased by a plug-in feeder unit that automates open-back inclinable presses. Parts are fed into dies at rates from 40



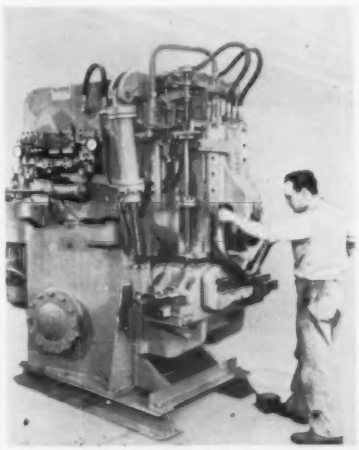
to 60 pieces per minute. Mounted on the side of a press, the unit feeds parts from an operator-fed, preload station outside the die area. Parts are removed from the die by air ejection or other automatic unloading means.

Press Automation Systems, Inc., 25418 Ryan Rd., Warren, Mich. **Circle 444**

USE READER SERVICE CARD ON PAGES 303 or 455 TO REQUEST ADDITIONAL TOOLS OF TODAY INFORMATION

Tube-Bending Press

Progressive bends are formed at rates up to 800 an hour by this 30-ton press. The unit produces bends on work equivalent to 3-inch OD x 0.125-inch wall steel tubing and on laminated tubing up to 2½-inch diam.



Fast cycling is provided with the 10-station angle-of-bend turret with pick-out type adjustable pins. The press is powered by two 20-hp motors.

Pines Engineering Co., Inc., 601 Walnut St., Aurora, Ill. **Circle 445**

TOOLING COSTS TOO HIGH?

GOODYEAR AIRCRAFT SAVES 50% TO 75% IN TOOLING COSTS BY FORMING ALUMINUM ON HYSOL EPOXY TOOLING DIES

Goodyear Aircraft is but one example of how Hysol Epoxy Tooling cuts cost. It can help you, too. Two major factors in tooling costs are material and time. Because a Hysol Epoxy tool can be cast or laid up directly from the master mold without hand barbering or fitting, skilled labor time is cut to a minimum and expensive machinery is eliminated. To get complete information on how Hysol Epoxy Tooling can help you cut tooling costs write — TOOLING

PROGRESSIVE PRODUCTS THRU CHEMICAL RESEARCH

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Use Reader Service Card, CIRCLE 110

OSBORN

BEFORE BRUSHING
Insulation residue on this small, copper electric motor commutator was a knotty, costly cleaning problem. Rate: 800 per hour.

AFTER BRUSHING
Surface quality-finished . . . insulating material and feather burrs gone . . . ready for trouble-free assembly. Rate: 3500 per hour.

Production soars from 800 to 3500 pieces per hour

...with OSBORN power brushing

PRODUCING at the rate of 3500 pieces per hour (over 330% greater than former off-hand method) these Osborn TY® Master® Wheels remove troublesome phenolic-type residue from electric motor commutators at Dayton Precision Manufacturing Co.

Slow, off-hand methods were being used to remove insulation residue from these commutators. Production was costly . . . parts lacked uniformity.

A specialized, but simple machine now handles the operation. Parts are automatically fed along a guide tube and through a pair of Osborn TY® Master® Wheel brushes. In this centerless type finishing setup—the job is done effectively in pre-set time cycles. Results: production and quality up—rejects eliminated . . . time and costs down.

Cleaning and finishing problems in your plant can be solved with similar production savings. An **O**sborn **B**rushing **A**nalysis—made in your plant now at no cost or obligation—is the first step. Write us for full details. *The Osborn Manufacturing Company, Dept. K-61, Cleveland 14, Ohio.*

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Booth 1305

Osborn Brushes

METAL FINISHING MACHINES . . . AND FINISHING METHODS
POWER, PAINT AND MAINTENANCE BRUSHES • FOUNDRY PRODUCTION MACHINERY

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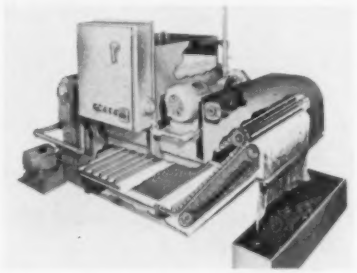
Coolant Filter

Completely automatic, this unit is designed to operate with pressure and vacuum on the filter media and the lowest possible liquid inlet height. Media travels on the bottom of a settling tank and above a vacuum box. Dirty coolant

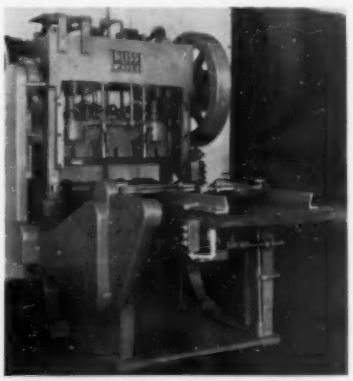


returning from the machines enters the filter approximately 18 inches from the floor, and passes downward to the filter media where all contaminants are removed. Dirt remains on the filter media and clean liquid passes to the filter pump which moves it directly to the machine or to a clean reservoir. Completely contaminated media is discharged into a hopper.

Hydromation Filter Co., 19661 Schoolcraft Ave., Detroit 23, Mich. **Circle 446**

Multiple Die Press

Screw caps, tape cans and similar items can be produced at a rate of 10 or more caps per stroke with this multiple die press. Operating speeds range

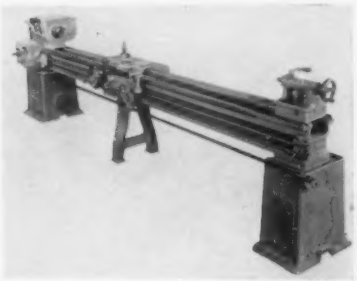


from 100 to 125 spm. Model 660D produces eight 48 or 53-mm caps per stroke. The larger model, 6100B, produces 10 70-mm caps per stroke or a correspondingly lower number of larger size caps.

E. W. Bliss Co., 1375 Raff Rd., SW., Canton, Ohio. **Circle 447**

Long-Bed Engine Lathe

Model GH geared head, long-bed engine lathe has either a 16 or 18-inch swing and center distances to 132 inches. Center distances to 158 inches are optional. The headstock has 12 spindle

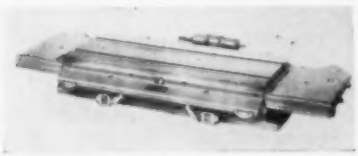


speeds ranging from 20 to 900 rpm. Spindle is LO type taper nose or threaded nose (optional). The gearbox has 48 separate threads and feeds, and levers provide 3 to 184 tpi.

Carroll-Jamieson Machine Tool Co., Batavia, Ohio. **Circle 448**

Indexing Slide Table

Two working positions are provided in this indexing slide table. Slide movement is powered by a three-inch bore air cylinder or a two-inch bore hydraulic cylinder. Stroke length is adjustable from 1 to 15 inches. Slide cycle control is obtained with optional valve and electrical combinations.



Surface of the top slide is 30 x 12 inches. Two longitudinal 5/8-inch T-slots are spaced six inches apart. End guards keep the dovetail way covered in all slide positions. A pre-wired electrical control kit, providing manual or automatic operation, is optional.

Russell T. Gilman, Inc., 623 Beech St., Grafton, Wis. **Circle 449**

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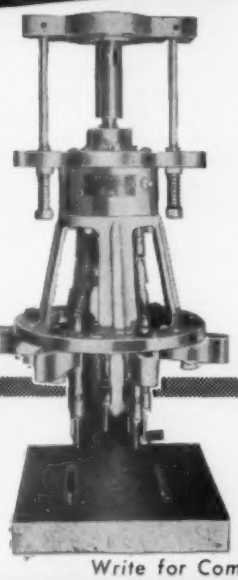
End Mills

Additions to a line of end mills include sizes up to 2½-inch diam in various styles. Two-flute, single-end mills come in stub, medium and long lengths; 4, 6 and 8-flute single-ends in regular, medium, long and extra long lengths and in single-ball type.

The cutters are form milled with

ERRINGTON

UNIVERSAL JOINT ADJUSTABLE TAPPING & DRILLING HEAD



Here's another hi-speed production tool from Errington. This dependable tool is adjustable to any pattern of holes . . . is available with 4 or 6 spindles. Positive clutch drive and reverse. Head made of the best grade sand Cast Aluminum with hardened and ground gears and spindles (made in one piece). Full grooved ball thrust bearings at all thrust points and Oilite bronze radial bearings. *Remember to do more . . . better . . . faster . . .* rely on Errington Hi-Speed Production Tools.

#0—0" to ¼" Tap Capacity
Min. centers 11/16"
Max. Pattern 5¼"

#1—7/32" to ½" Tap Capacity
Min. centers 1½"
Max. Pattern 8"

LESS THAN ½ MINUTE TO CHANGE HEAD FROM DRILLING TO TAPPING OR TAPPING TO DRILLING

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ERRINGTON Mechanical Laboratory, Inc.

Established 1891

Main Office and Plant STATEN ISLAND 4, NEW YORK

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Improve your PRECISION . . . and PRODUCTIVITY!

SWITCH FROM "DEAD" CENTERS TO

VEE-ARC SUPER-PRECISION "LIVE" CENTERS

Guaranteed Accurate to .000020" (twenty millionths)

Designed for ULTRA-PRECISION TURNING and GRINDING OPERATIONS!

SUPERIOR FEATURES:

- Extended spindle . . . CARBIDE TIPPED!
- Life-time lubricated, pre-loaded ABEC-7 ball bearings
- Spring compensation to .020" axial growth without impairing accuracy
- Heat-treated, stainless steel construction

For your convenience, Vee-Arc Super-Precision Live Centers are also available through your Monarch and Cincinnati Lathe distributors.

VEE-ARC CORPORATION, Dept. BB-10 Westboro, Mass., U.S.A.

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precision ground form-relieved lands. Blended flute contours have no sharp edges or corners. The design provides improved chip clearance, high production and long life.

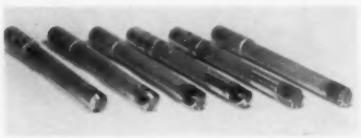
Eclipse Counterbore Co., 1600 Bonner Ave., Detroit 20, Mich. **Circle 450**

USE READER SERVICE CARD ON PAGES 303 or 455 TO REQUEST ADDITIONAL TOOLS OF TODAY INFORMATION

Gun Reamer

Multiple flute, carbide pressure-coolant reamers produce holes to precision size and finish specifications in steel, aluminum, cast iron and bronze parts. They function in either drilled or cored holes and are adapted to precision reaming of long holes.

The Starbore reamer has a molded carbide tip brazed to a tubular steel shank. Pressurized coolant (from 75 to 300 psi) is directed through the shank into angular holes at the ends of each flute in the tip. The coolant forces chips ahead of the tool, preventing wedging between the hole surface and tool cutting edges.



Reamers are available with a variety of numbers of either straight or spiral flutes for applications up to four-inch diam. Reamers over 1½-inch diam have brazed-on carbide insert cutting surfaces. Shanks are straight or tapered and custom lengths are available.

Star Cutter Co., 34500 Grand River Ave., Farmington, Mich. **Circle 451**

Automatic Welding Wire

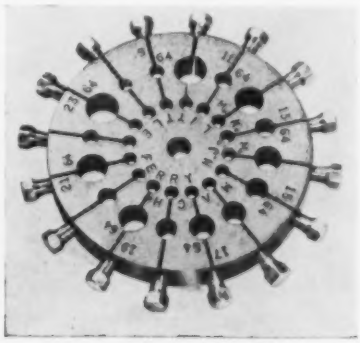
Welding wires of low carbon, general mild steel; high tensile steel; mild steel killed; general high tensile and medium carbon steel are for use with submerged arc welding processes. Alloys in the line are controlled to fuse with the parent metal and give comparable physical and chemical characteristics across the base metal, the affected zone and the weld metal.

Wire is available in thread-wound coils in weights of 25-30, 55-65, 75-100, 120 or 180 lb and in fibreboard drums of 200, 500 and 750 lb.

Air Reduction Sales Co., 150 E. 42nd St., New York 17, N. Y. **Circle 452**

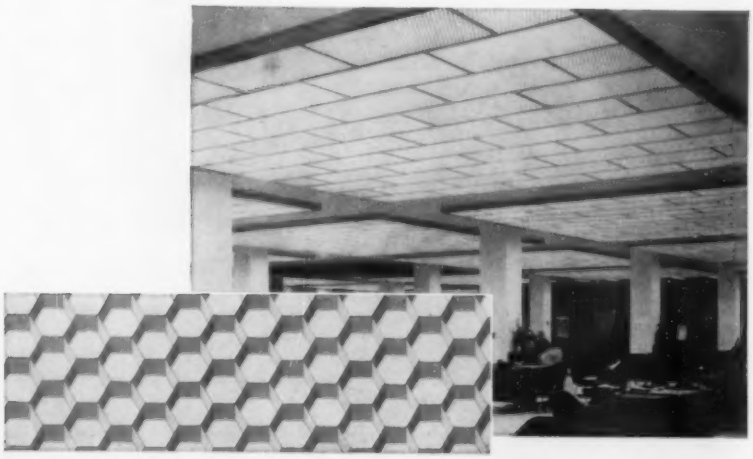
Lapping Tool

A versatile clusterlap unit will lap reamers, cutting oversize to precision sizes, without removing the reamer from the machine setup. One lap provides 16 adjustable sizes. Six models provide a



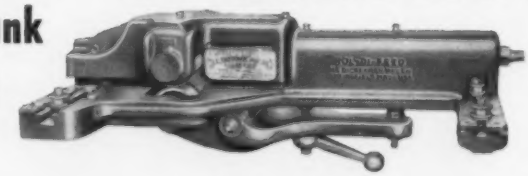
range of from 1/32 to 1 inch. The unit will lap standard drills to off sizes and can be used for final sizing and finishing of plug gages.

M K M Machine Co., 325 Main St., Little Ferry, N. J. **Circle 453**



Dickerman Rol-Di-Feed®

Handles 36" Wide Aluminum Stock for New Bank Ceiling!



Cellular gold anodized ceiling panels in the new National Bank of Detroit add considerably to the effective interior design. Two Dickerman 12" Rol-Di-Feeds, one right hand and one left hand, gently and accurately fed the 36" wide coiled aluminum stock to stamping presses to make these efficient, functional luminous panels possible.

Not all press feeding problems are as unique—but, demanding punch press feeding problems can usually be solved quickly, reliably, economically from 14 off-the-shelf, "standard" Dickerman Punch Press Feeds.

Dickerman

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THE H. E. DICKERMAN MFG. CO. 321-327 Albany St. • Springfield, Mass.

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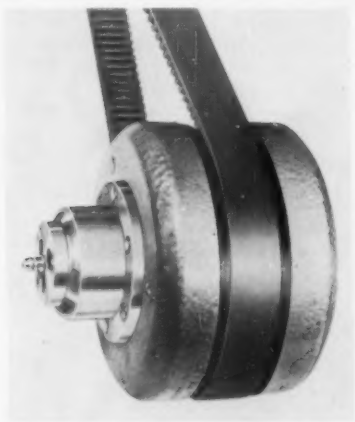
Variable Speed Pulleys

Speed ratios of 3:1 are provided in a line of cam-operated pulleys that have V-belts, V-belt sheaves and adjustable motor bases. They are rated for 1, 1½, 2, 3 and 5-hp motors at 1750 rpm and for ¾ to 3¼-hp motors at 1150 rpm.



Bore sizes, varying with the model, are ⅝, ¾, ⅞, 1 and 1⅛ inch, with bore lengths from 2½ to 3⅝ inches and motor travel for full speed range 3⅛ to 4 inches.

Hi-Lo Mfg. Co., c/o Lovejoy Flexible Coupling Co., 4878H W. Lake St., Chicago 44, Ill. **Circle 454**

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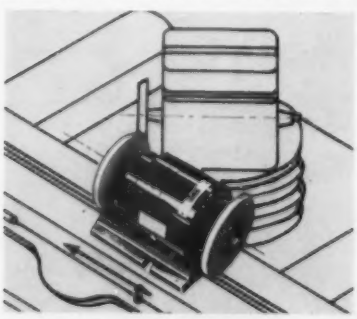
Diamond Wheel Dresser

Minimum removal and consequent minimum loss of diamond surface is possible with this diamond wheel dresser. The motorized unit for carbide



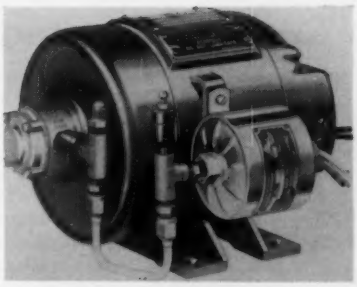
tool and die production and maintenance has dressing wheels which operate at 3450 rpm. Friction driving pressure and hogging are eliminated. Direction of rotation is controlled by reversing the machine's position on the table. Clamps or magnets hold the base of the dresser to the bed of surface or cutter grinders.

Niagara Cutting Div., Bollier-Damerell, North Tonawanda, N. Y. **Circle 455**

Oil-Free Air Pump

Servicing and oil contamination are eliminated with this pump designed for industrial processes or machines requiring automatic pressure to 20 psi. Model RG10470 has prelubricated bearings, self-lubricating thrust plates and blades, oil-free impeller parts and no seals or shaft packings. A common shaft transmits motor power to the pump rotor and sliding blades.

Rated capacity of the pump is 0.3 cu fpm of free air delivery. Displacement is 0.304 cu fpr. The single-phase motor



develops ⅓ hp at 3450 rpm.

Lear, Inc., 110 Ionia, NW., Grand Rapids, Mich. **Circle 456**

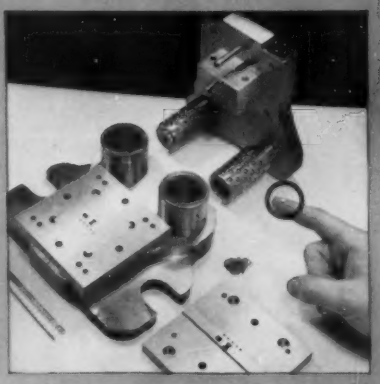
NOBODY SAID "It Couldn't Be Done"

BUT ONLY LEMPCO 2 POST STOCK* DIE SETS COULD DO IT!

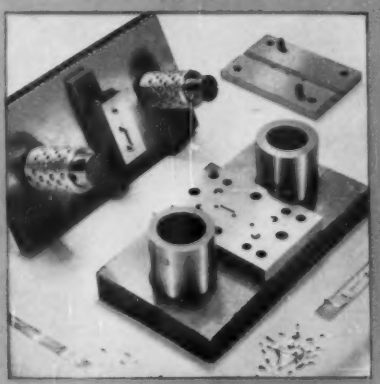
To the best of our knowledge, Lempco is the only 2-post STOCK* die set which could produce this electronics part from .001" thick high nickel alloy material—with punched holes of .001" diameter. This die, mounted in a standard Lempco STOCK* die set, produced 30,000 burr-free parts on its initial run.

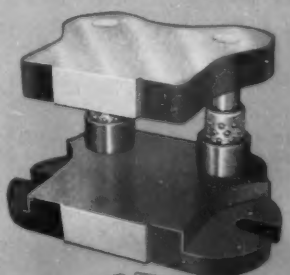
Users everywhere have found that a STOCK* Lempco 2-post die set will out-produce special 4-post "friction type" sets—at a fraction of the cost. You can prove this to yourself!

*Off-the-shelf DELIVERY, with warehouse stocks in all major metalworking areas of the U.S.A.



MATERIAL: .001" Thick, High Nickel Alloy Punched Holes, .001" Diameter





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Diebuilder: Vamco Machine & Tool, Pittsburgh

LEMPCO INDUSTRIAL, INC.

DUNHAM RD. · BEDFORD, OHIO

Tel. MOntrose 2-2400 — Cleveland Exchange

WHERE QUALITY CONTROLS

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Plastic Paste

Characteristics of an epoxy resin-based material include ease of mixing and application, fast curing, dimensional stability and adhesiveness. RP-301 can be applied with a brush, spatula or other tool. Use of a heat lamp increases flow of the paste, eliminating the possibility of air entrapment. Curing time is up to 30 minutes. The material can be used in pattern making as a substitute

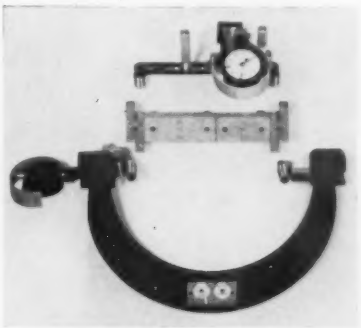
for plaster of paris, and for pattern repair.

Ren Plastics, Inc., 5422 S. Cedar Rd., Lansing 9, Mich. **Circle 457**

Thread Comparators

Illustrated below are (top) Model GG-C200 internal bi-roll comparator; (bottom) Model 450-X bi-roll external comparator; and Model DD-7 bar for setting both internal and external sizes to actual pitch diameter without the use of setting plug and thread ring gages.

Both gages are light weight for easy handling, rigid enough to provide accurate results, and provide the maximum flexibility necessary to meet requirements of the low volume production and frequent size changes of large parts. Both models are equipped with either go rolls for assemble-ability measurement, or not-go rolls for pitch diameter measurement. Rolls of different pitch can be interchanged.

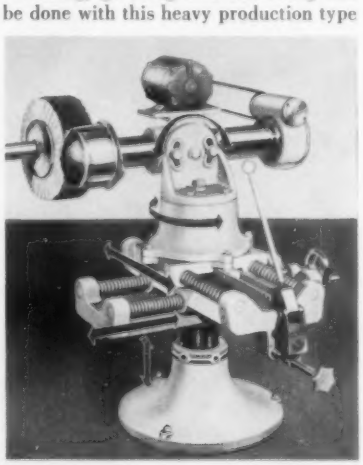


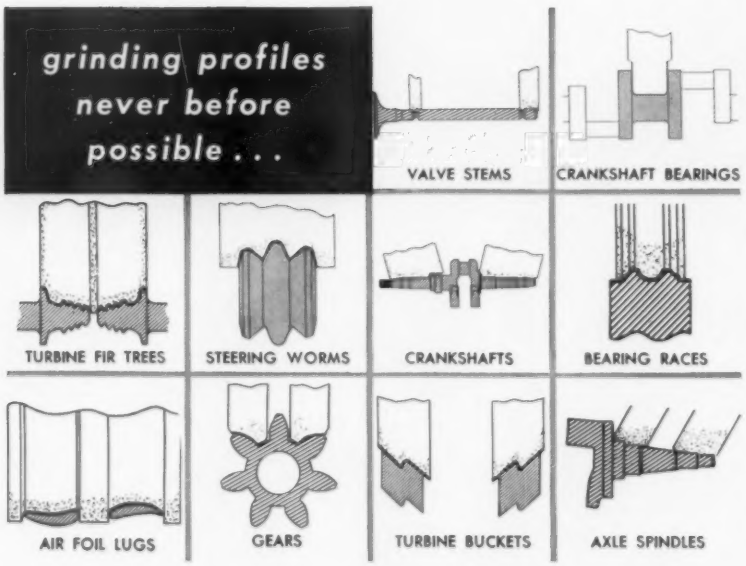
The internal gage checks threads from 4¼ through 30 inches. It collapses, is inserted in thread, expands under spring pressure, and size of thread is read from dial. The external comparator is adjustable in 2-inch increments per frame and is available in sizes from 2⅝ through 30 inches.

The Johnson Gage Co., 534 Cottage Grove Rd., Bloomfield, Conn. **Circle 458**

Finishing Machine

Buffing, grinding and deburring can be done with this heavy production type





now routinely ground to "tenth tolerance" accuracy

HOGLUND CONTOUR WHEEL DRESSERS

Hoglund Contour Wheel Dressers incorporate an ingenious inclined plane mechanism which enables dressing of almost any profile to accuracies of .0001". The dressers feature interchangeable master contour templates. Diamonds are optically pre-set, eliminating dresser adjustment or down-time for replacements. Hoglund Dressers can be hand or automatically controlled. They can be installed on grinders already in service or as original equipment

120 Different Types . . .

Adaptable to all grinders including surface, cylindrical, centerless, spline and gear, double spindle, microcentric.

PROFITABLE CONTOUR GRINDING . . . For economical solution to tough contour grinding jobs, send your part prints for recommendation and quotation. Catalog and literature yours for the asking.

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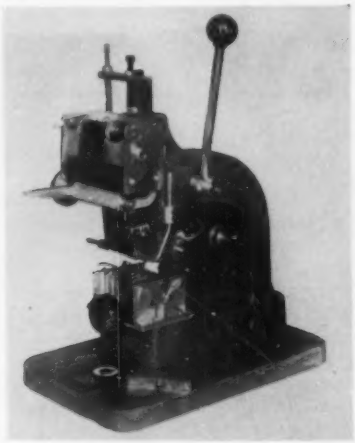
unit. In some cases, one operator can service more than two machines. The machine has a wide variety of interchangeable components, making it possible to finish workpieces of many shapes.

Murray-Way Corp., P. O. Box 180, Birmingham, Mich. **Circle 459**

Wire and Tube Marker

Model HWM-2 hand-operated marking machine is equipped for 110 volts a-c or d-c. The heat range of from 100 to 600 F is thermometer and thermostat-controlled. A rheostat can be supplied. Foil feed is adjustable and automatic, and rewinds used foil. Replaceable holders take up to 1½ inches



of type. The guide is adjustable for wire sizes AN-26 to AN-0000 and for tubing from 1/16 to 1¼-inch OD. Stamping depth is adjustable and will not creep. A flat anvil or fixtures for hot stamping of small parts, monogram work and other applications are optional. Motor drive is available.

Automark, 1920 S. Vanseventer Ave., St. Louis 10, Mo. **Circle 460**

Power Shear

Cutting speeds of up to 160 spm are possible with this No. 48 four-foot power shear. The machine has an inclined ram, 14-gage material capacity in mild steel over a 50-inch cutting length, triple V-belt drive, and four edged cutting blades. The electric clutch, material chute and bed are adjustable.

O'Neil-Irwin Mfg. Co., 625 8th Ave., Lake City, Minn. **Circle 461**

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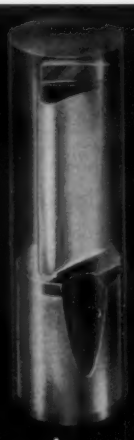
Bending Brakes

Intricate shapes are turned out accurately without dies or tooling with Form-All bending brakes. The brakes produce combinations of bends and one-piece parts such as narrow, webbed deep channels; closed, rectangular tubes; and double-jacketed channels.

In angle bending from 0 to 155 deg, a pair of wings pivot about a point off the tip of a holding blade. In radius bending, the wings travel along a curve of the desired radius. Hand, air and hydraulically powered models are available in a variety of sizes.

Lake Erie Machinery Corp., Buffalo 17, N. Y. **Circle 462**

Get CARBIDE PERFORMANCE at TOOL STEEL COST...



Ferro-Tic* (with proven performance)

the only machinable carbide in existence!

FOR: Blanking, Lamination, Deep Drawing and Heading Dies, Arbors, Core Rods, Wear Parts, etc.

FERRO-TIC combines the fabricating advantages of steel with the wear-resistance of carbide. In the annealed, completely dense state, **FERRO-TIC** can be machined with high-speed steel tools on conventional tool room equipment; thus, the need for costly diamond grinding is eliminated. Once hardened, by oil quenching from 1750° F, **FERRO-TIC** is extremely hard and wear-resistant. **FERRO-TIC** stock blanks can be fabricated into long-wearing carbide components, using available tools and skills without delay!

FERRO-TIC can be turned, drilled, milled, sawed, tapped.

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ELYRIA FOUNDRY DIVISION, ELYRIA, OHIO

*Reg. U. S. Trade Mark

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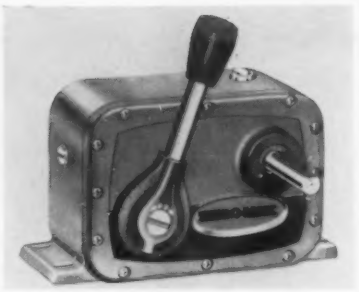
Variable Speed Drives

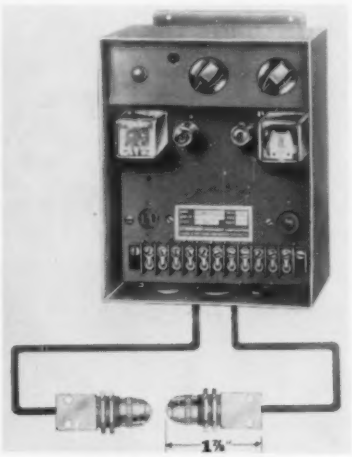
Design improvements in a line of 400 Series variable speed drives include built-in overload protection and a fast, precise speed setting control. Output range is from 0 to 1200 rpm with 1800-rpm input. Speed settings are instantly changeable and reversible. Torques are from 3 to 450 in-lb. Lever, vernier, screw or remote controls are available.



The Zero-Max Co., 1900 Lyndale, S., Minneapolis 5, Minn. **Circle 463**

Miniature Photo-Electric Controls

Designed for automatic industrial inspection, counting and control, these photo-electric controls have plug-in connection, and tube or transistor amplifiers. Light source, photocell and amplifier can be interconnected by plug-in



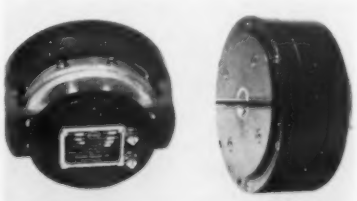
terminals and receptacles, permitting selection of units suited to job requirements.

Operating range of the controls is up to 20 ft, with extension to 100 ft if required. Speeds are up to 1000 counts per minute. Units can be provided for flush or panel mounting, or with swivel base and ball joint for alignment ease.

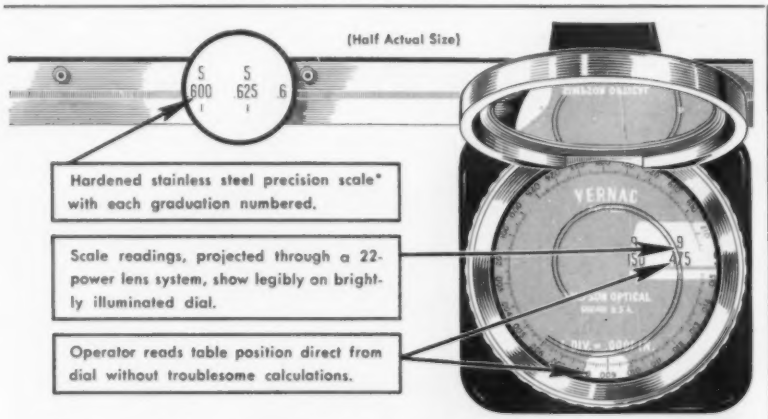
Standard Instrument Corp., 657 Broadway, New York 12, N. Y. **Circle 464**

Printed Circuit Motors

Smooth torque at low speeds and low armature inertia allow "printed" motors to be used for direct drive in servo applications without gear trains.



A flat printed circuit, instead of the usual wire-wound armature, is used in these motors. The light weight of the rotating portion—about one-eighth that of a conventional armature—permits the motor to reach full speed in a few thousandths of a second. Two sizes are available. The larger motor, Model PMI-PM488, is 5⅝ inches in diameter and 3 inches long. Operable only on direct current, speed of the motor is


(Half Actual Size)
Hardened stainless steel precision scale* with each graduation numbered.
Scale readings, projected through a 22-power lens system, show legibly on brightly illuminated dial.
Operator reads table position direct from dial without troublesome calculations.
VERNAC

New optical measuring instrument assures . . .

high operating accuracy for new or used machine tools

The new VERNAC Direct Reading Optical Measuring Instrument eliminates the complexities of using end rods and gage blocks. Now, the longitudinal, lateral or vertical positioning of machine tool tables can be quickly and easily read direct to .0001". Accuracy is not affected by the wear or stretch of table movement screws. The instrument itself has no moving parts which can impair accuracy.

VERNAC instruments also up-grade machine tools to perform tasks beyond their original accuracy. For example, they can up-grade moderately priced milling machines to the accuracy of more expensive jig boring machines at a fraction of the latter's cost.

*The scale is a replica of a master certified by the U.S. National Bureau of Standards to .0001" maximum error over its entire length.

SEND FOR FREE BULLETIN. Explains how the VERNAC enables you to do more precise work on your present machine tools.

VERNAC® UNITED STATES AND FOREIGN PATENTS PENDING

Designed and Manufactured by
SIMPSON OPTICAL MANUFACTURING CO.
3202-04 Carroll Ave., Chicago 24, Ill.

Visit Booth 1830 at the ASTE Tool Show. See the VERNAC demonstrated

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Simpson Optical Manufacturing Company, 3202-04 Carroll Ave., Chicago 24

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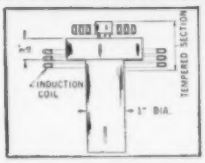
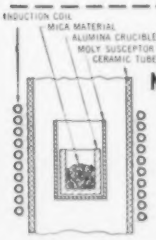
Lepel induction heating equipment represents the most advanced thought in the field of electronics... the most practical and efficient source of heat developed for numerous industrial applications. You are invited to send samples of work with specifications. Our engineers will process and return the completed job with full data and recommendations without cost or obligations.

TYPICAL INDUCTION HEATING APPLICATIONS



Punch Heads Selectively Tempered

Diagram shows arrangement for selectively tempering heads of alloy steel punches. The use of a combination type solenoid and pancake induction coil reduces hardness from Rc 55/56 to Rc 41/44, improving resistance to brittle fracture at the head of the punch. In this case a heating cycle of 55 seconds provides uniform tempering. A multiple position fixture, processing 4 pieces at one time, speeds up production.



Heating Non-Conducting Materials To High Temperatures

Laboratory analyses frequently require heating of non-conducting materials to temperatures of 3,000 to 3,500° F. in vacuum or special atmosphere. This can be accomplished by induction heating with the aid of a metal susceptor. Diagram shows the fusion of mica samples in an alumina crucible, using molybdenum susceptor. A ceramic tube surrounding the susceptor isolates the work for fusion in a vacuum. The molybdenum susceptor is heated by induction, which in turn, heats the crucible by radiation.

WRITE FOR NEW LEPEL CATALOG

Electronic Tube Generators from 1 Kw to 100 Kw. Spark Gap Converters from 2 Kw to 30 Kw.

Lepel HIGH FREQUENCY LABORATORIES, INC.

55th ST. & 37th AVE., WOODSIDE 77, N. Y.

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4000 rpm, torque is 32 in-oz, hp is 0.125 and power input is 180 watts.

Photocircuits Corp., 31 Sea Cliff Ave., Glen Cove, N. Y. **Circle 465**

Reversible Surface Plate

Double-faced black granite surface plate can be finished on both sides, providing double plate life at one third more cost than a single-faced plate. Available in all standard sizes, both surfaces may be finished with the same grade or with a combination of standard grades, AA (laboratory), A (inspection) or B (shop).

The reversible plates can be turned easily by means of trunnion bolts screwed into the threaded inserts imbedded flush into the side of the plate. A "C" clamp will hold work or fixtures rigidly to the plate.

The DoAll Co., Des Plaines, Ill. **Circle 466**

Quick-Set Chuck

Adjustable within 0.0002 inch in 30 seconds, turning of just two screws locks this chuck during heavy or intermittent cutting operations. The external

adjustable screws are diametrically opposed by two internal flat springs which eliminate backlash.

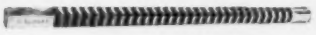
The Whiton Machine Co., New London, Conn. **Circle 467**

SAVE TIME with STANDARD STOCK BROACHES

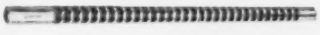
Minute Man KEYWAY BROACH KIT

In one minute and for as little as one cent you can cut a keyway with this kit. For keyways from 1/16" to 1" in any bore from 1/4" to 3".

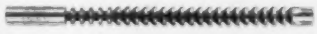
Minute Man



SQUARE BROACHES

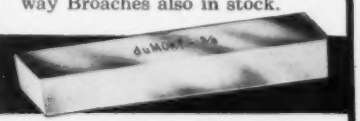


HEXAGON BROACHES



New ROUND BROACHES

Used in an arbor or hydraulic press for finishing holes to exact size in *one pass*. 1/8" to 3/4" squares and hex's; 1/4" to 1" rounds. Production Type Keyway Broaches also in stock.



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An almost perfect balance of *wear resistance*, *toughness* and *red hardness* gives duMont Tool Bits a definite edge in cutting life, gives you more cuts per bit, more cuts per dollar.

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Greenfield, Massachusetts

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☐ Minute Man BROACHES and KITS

☐ duMONT Super H.S. TOOL BITS

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Company.....

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BOOTH 647—ASTE TOOL SHOW

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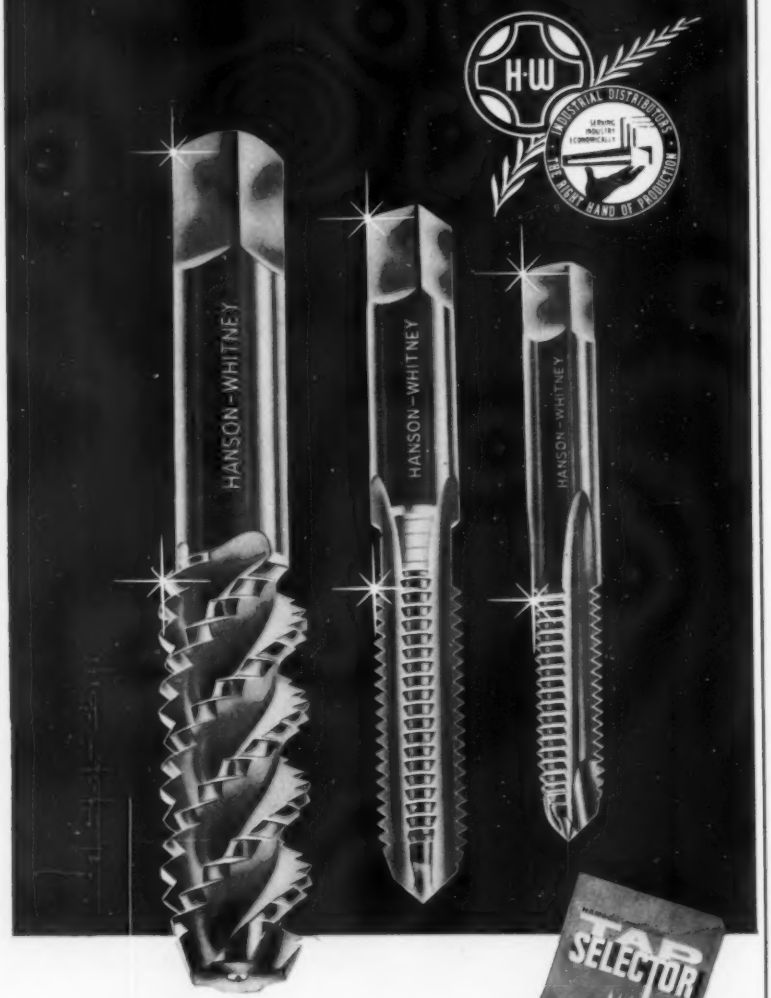
DON'T PAMPER THESE TAPS

....they can take it!



Hanson-Whitney has now standardized its line of Taps for "off-the-shelf" selection with all types and sizes measuring up to the most exacting requirements.

These Taps can be used at high speed operation on the difficult modern metals required in today's production.

H-W products are stocked by leading Distributors, with Technical Engineering Service readily available.

Write for the NEW Hanson-Whitney **Tap Selector** showing how to **quickly** make the proper tap selection. **It's free!**

THE Hanson-Whitney COMPANY

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TAPS • GAGES • COMPARATORS • HOBS • CUTTERS

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Arc Welding Control, Torch

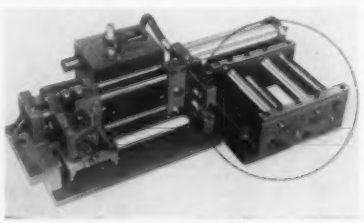
An arc welding control with wire drive and an arc welding torch are designed for consumable electrode welding processes using shielding gases such as argon, helium or carbon dioxide in making horizontal fillets and flat position welds. They are powered by direct current for use in semiautomatic processes.

The portable, skid-mounted WC-1 control has a wire feed rate of from 55 to 500 ipm with $\frac{3}{64}$ to $\frac{5}{32}$-inch wire. The AM-1 torch has interconnecting gas, water and flexible conduit assemblies. All cables and hose, except the conduit, enter at one point of the handle.

National Cylinder Gas Div., Chemetron Corp., 840 N. Michigan Ave., Chicago 11, Ill. **Circle 468**

Stock Straightener

Rolls of this coil stock straightener take curvature from coil stock and deliver it smooth and flat to the press. The

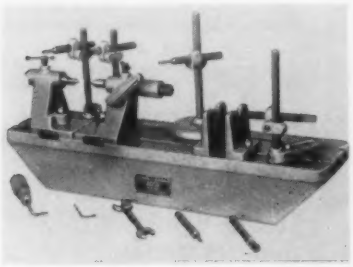


nonpowered units are made in stock width sizes of 6, 12 and 18 inches, and have maximum capacities ranging from 6 x 0.125 inches in mild steel, in the 6-inch size, to 18 x 0.045 inches in the largest model. The unit can be used with varied air-operated automatic feeds.

Cooper Weymouth, Inc., 600 Honeyspot Rd., Stratford, Conn. **Circle 469**

Bench Setter and Surface Plate

Accurate inspection of all types of work can be done with this bench center and surface plate. Workpieces can be mounted between centers, in V-rests directly or on the surface plate.



Runout is shown on dial indicator as work is rotated by hand. Side runout or camming action can be checked with second indicator.

Alloy steel or carbide centers are available. Distance between centers is 22 inches, height from centers to plate is 4.130 inches, and diameter of work over surface plate is 8¼ inches. Base length is 28 inches.

K. O. Lee Co., Congress at First Sts., Aberdeen, S. D. **Circle 470**

Hour Meters

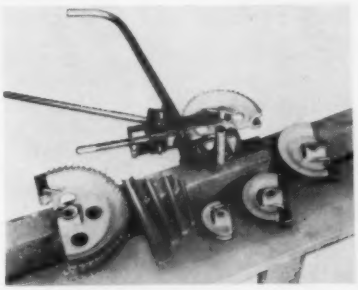
Cumulative operating time up to 100,000 hours is recorded in hours and minutes on the face of this meter. It

will record time data from any machine, tool or other equipment powered with 120 to 480-volt alternating current. The meters are available in diameters of 2½ or 3½ inches.

Hobbs Div., Stewart Warner Corp., Springfield, Ill. **Circle 471**

Bench Bender

Repair or maintenance work and on-the-job applications can be handled with this bench bender that performs compression type bending, giving shorter radii without mandrel use and requires less hand power. Its direct-lever operation will bend soft copper and



aluminum up to 1½-inch diam and annealed steel tubes up to 1-inch OD.

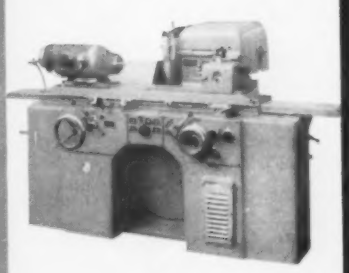
The unit provides ratchet bending action for steel tubes to 1½ inch. Two ratchet dies, 1¼-inch OD and 1½-inch OD, have cast-in ratchet teeth with ratchet lever attachment, doubling manpower. The bender has five sets of dies in sizes ½, ¾, 1, 1¼ and 1½-inch OD.

Wallace Supplies Mfg. Co., 1304 Diversey Parkway, Chicago 14, Ill. **Circle 472**

USE READER SERVICE CARD ON PAGES 303 or 455 TO REQUEST ADDITIONAL TOOLS OF TODAY INFORMATION

olivetti

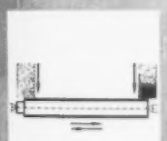
high-precision grinding machines with hydraulic automatic infeed for traverse grinding and plunge grinding



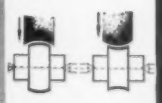
UNIVERSAL. *Swivelling wheelhead, swing-down internal grinding attachment, infinitely variable speed headstock.*

PRODUCTION. *Larger grinding wheel, more horsepower, non-swivelling wheelhead, 8-speed headstock.*

Model R4-500 U shown at left. Universal type, 10" swing, 24" center distance.

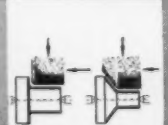


See Us At ASTE Show Booth 1660



- *Infinitely variable hydraulically controlled table speeds*
- *Table reversals within ± .0002" as short as 1/16"*
- *Table dwell 0 to 20 seconds*
- *Automatic precision infeed to .000050", right, left or both ends of traverse*
- *Thumb jog for taking .0001" cuts on diameter*
- *Separate automatic plunge feed 0 to .002"/second to positive stop*

write Olivetti Corporation of America, 42-33 Northern Boulevard, Long Island City 1, New York Or phone RAvenswood 1-7575.



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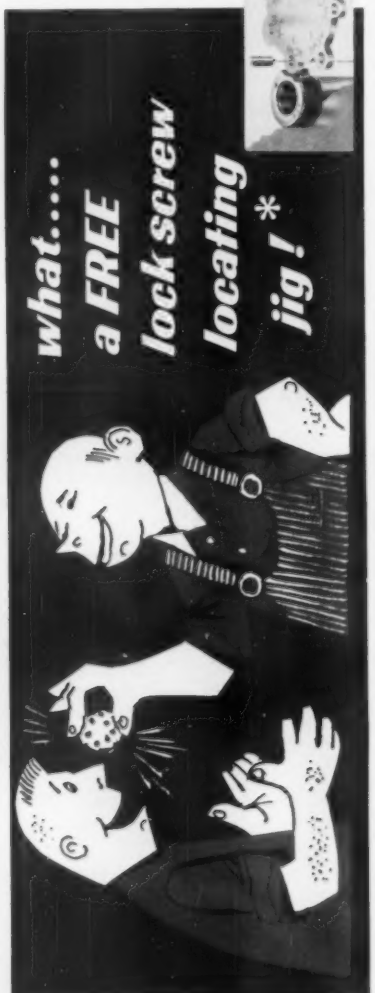
* Acme Industrial figures your time is money. So . . . Acme saves it for you. The FREE Lock Screw Locating Jig instantly gives location for lock screw drilling and tapping. Handy? You bet. Free? Honest. A daily time and work saver? Certainly. No, Acme bushings (all 30,000 sizes of them) aren't free, too. But just as important, they're close as your nearby Acme distributor. Fastest delivery standard . . . finest quality (a tradition) expected . . . dependable precision remarkably perfect.

what..... a FREE lock screw locating jig! *



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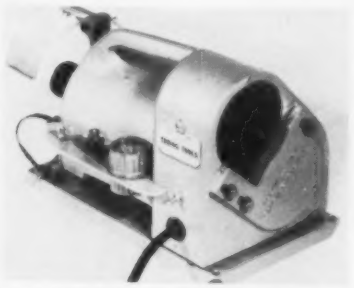
TOOLS of today

Buffing Machine

Copper fittings and tubing up to four inches in diameter can be cleaned and deburred with this portable machine. It will handle both internal and external operations and can be used for cleaning threaded parts.

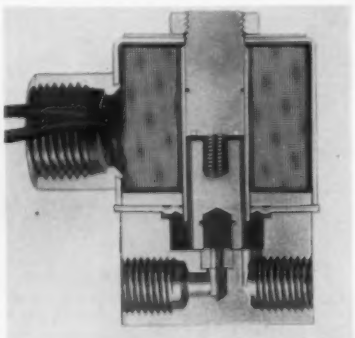


A four-inch main brush with adjustable reverse-L guide handles all external cleaning operations. Three sizes of brushes and a rotary internal deburring tool work off the other end of the motor shaft under a clear plastic guide. The machine is 10 x 10 x 17½ inches and weighs 52 lb.

Toledo Pipe Threading Machine Co., Toledo, Ohio. **Circle 473**

Solenoid Valves

Packless, two-way, normally closed valves, in Series A (illustrated) for ⅛ and ¼-inch pipe and Series B Midget valves for ⅛-inch pipe, can be used with air, water, oils and gases. They provide



either grommet or conduit (360-deg rotation) type electrical connection, with 24-inch leads. The spring-loaded plunger operates in any position. The valves are operable at 115 volts, 60 cycles at maximum working pressures of 110 (Series A) and 90 (Series B) psi. A built-in outlet flow control is optional.

C. A. Norgren Co., 3400 S. Elati St., Englewood, Colo. **Circle 474**

(Continued on page 287)

When buying cutting tools insist on . . .

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CAST ALLOY CUTTING TOOL SPECIALISTS

- UP TO 35% MORE PIECES PER GRIND . . . than other cast alloy tools
- DOUBLE CUTTING SPEED . . . over high speed steel tools
- CROBALT TOOLS WITHSTAND CHATTER, INTERRUPTED CUTS and HARD SPOTS . . . where carbide tools chip and break
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Gentlemen, please send your complete catalog information on your line of standard and custom Crobalt cutting tools.

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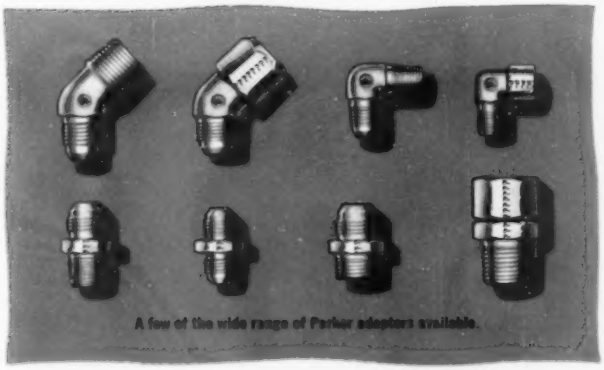
For literature on Fittings & Hose, CIRCLE No. 125A

Now from Parker

BOTH permanent-end and re-usable hose assemblies

Parker "Krimp-lok" hose assemblies — supplied in a wide variety of fittings-and-hose combinations for any type of service and fluid.



A few of the wide range of Parker adapters available.

You may require permanent-end hose assemblies for your production AND re-usable fittings with coils of hose for quick, trouble-proof replacements in the field. With the addition of Parker's new "Krimp-lok" fittings, permanent-end assemblies are now available from Parker. They use the same Parker hoses that enjoy a wide acceptance when used with Parker *no-skive* "Hoze-lok" fittings in the replacement field.

A full range of Parker adapters is also available.

Ask your Parker Hose Distributor, listed in the Yellow Pages, for engineering advice and literature on "Hoze-lok" re-usable fittings, also Parker hose and adapters. Write us in Cleveland regarding your requirements for Parker "Krimp-lok" Hose Assemblies.

Parker

FITTINGS AND HOSE

DIVISION

17325 Euclid Avenue

Cleveland 12, Ohio

Parker "Hoze-lok" no-skive hose fittings and Parker hose, the ideal combination for short-run production and quick, reliable field replacement.

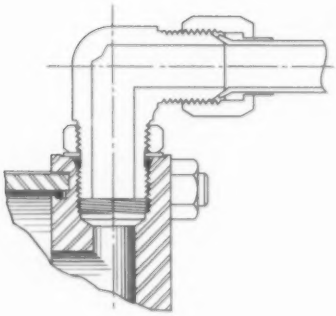
Bronze cartridge gland with "LIPSEAL"® and "WIPERSEAL" can be easily replaced without dismantling cylinder.

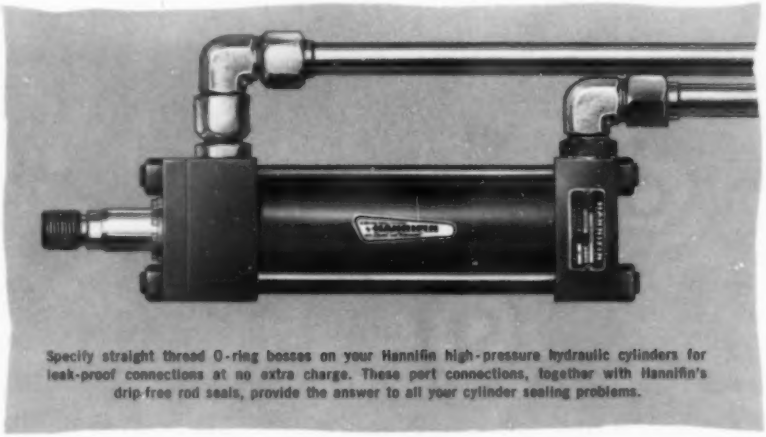
Drip-free rods, leak-proof ports...

get both with

HANNIFIN

hydraulic cylinders





Specify straight thread O-ring bosses on your Hannifin high-pressure hydraulic cylinders for leak-proof connections at no extra charge. These port connections, together with Hannifin's drip-free rod seals, provide the answer to all your cylinder sealing problems.

Select either "Step-Seal" piston rings (standard) for most applications or exclusive "LIPSEALS" where zero "clearance flow" is required.

For absolutely leak-proof connections under all operating and installation conditions, get Hannifin hydraulic cylinders with S.A.E. straight-thread ports. There's no extra cost. And because a straight-thread fitting is tightened *after* alignment, not aligned by "backing off," sealing is positive even when the cylinder must be mounted in tight quarters.

Straight-thread ports, plus the removable-replaceable cartridge gland that seals Hannifin cylinder rods drip-free, keep machines, floor and product free of hydraulic oil.

Other Hannifin cylinder features include ground and polished rods induction-hardened to an extra-deep case, then hard-chrome plated and polished again; cylinder walls that are "Tru-Bored" straight and perfectly round *before* being honed . . . PLUS 48-hour shipment in emergencies on standard Hannifin cylinders.

Your nearest Hannifin sales office or representative is listed in the A-Z volume of Thomas' Register. Call us in when cylinders figure in your designs. Or, for cylinder literature, write:

HANNIFIN COMPANY

515 South Wolf Road • Des Plaines, Illinois

DYNAMIC POLISHING AND DEBURRING

The GRIND-O-FLEX saves valuable production time in polishing and deburring rounded, contoured and flat surfaces. A flexible abrasive wheel that features SLASHED construction, type BL GRIND-O-FLEX practically envelopes the part with dynamic, moving abrasive.

Easy to use, economical, the GRIND-O-FLEX consists of a rugged hub that holds a number of simple-to-replace abrasive pads. No special tools are required to load the hub.

The pads, available in a variety of grits, wear evenly, exposing a continuously fresh abrasive surface.

Write today!..for illustrated technical bulletin and price list.

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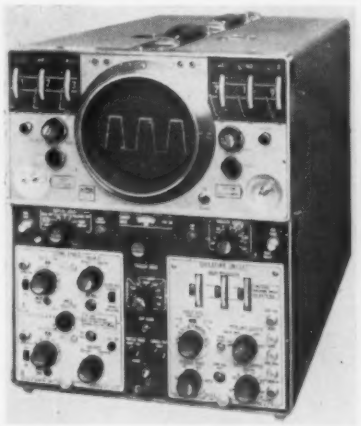
Oscilloscope

Direct digital-reading oscilloscope is suitable for manufacturing and process



control. The direct-reading feature makes it possible to reduce measurement and analysis time by 40 percent.

Allen B. Du Mont Laboratories, Inc., Clifton, N. J. **Circle 475**

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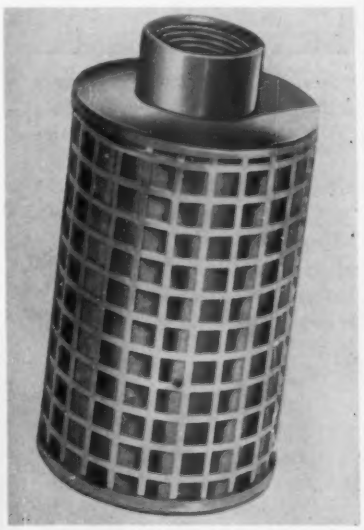
Hydraulic Suction Filter

Involute design of the wire cloth element in this suction filter provides approximately three times the normal filtering area, resulting in a higher oil flow capacity and negligible pressure



drop. At rated flows with 220 S.S.U. mineral base oil, the pressure drop is 0.5 psi or less. The filter element provides approximately 10 sq inches of filtering area for each gallon of flow.

Arrow Tools, Inc., 1947 S. Kostner Ave., Chicago 23, Ill. **Circle 476**

Pick the one that's right for your job!

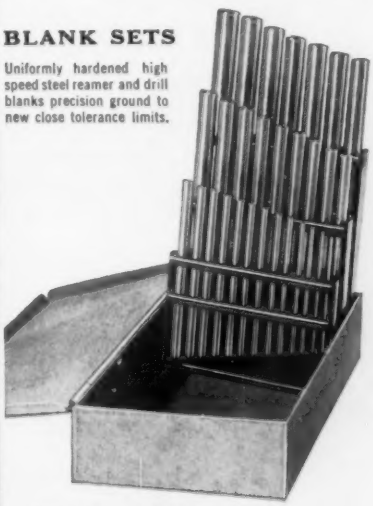
It pays to specify

ACE DRILLS REAMERS BLANKS

Carbide Tipped and Solid Carbide
Premium Quality High Speed Steel

BLANK SETS

Uniformly hardened high speed steel reamer and drill blanks precision ground to new close tolerance limits.



DRILL SETS

Standard stock sets include Fractional, Wire and Letter size drills, packaged in convenient folding index cases.

Call your local distributor today—or write Ace direct for latest catalog and price information.

ACE DRILL
Adrian, Michigan

ORIGINATORS OF "GROUND-FROM-THE-SOLID" DRILLS

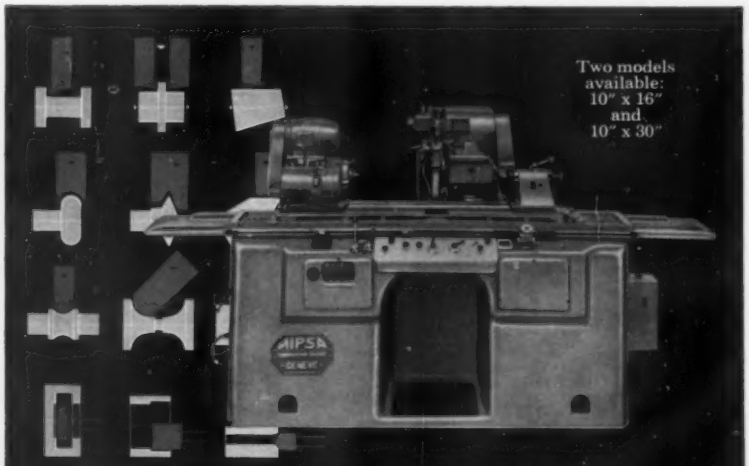
Use Reader Service Card, CIRCLE 127

Automatic CO_2 Welder

Wire of 0.020 to 0.045-inch diam is fed continuously into the weld zone in an automatic process for carbon dioxide shielded arc welding. The method is used with mild steel from 24 gage to ¼ inch in thickness.

Equipment used in the process includes a lightweight gun-cable assembly, wire feed unit, gas supply and regulation apparatus, and power source of the constant voltage or variable slope type. Advantages of microwire welding are high speeds in all positions with minimum distortion and little or no post-weld cleaning.

Hobart Bros. Co., Troy, Ohio. **Circle 477**



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Double swivel wheel head feeds at angle for accurate and simultaneous grinding of shoulders and O.D.

12" or 14" wheel up to 2" wide

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Available fully automated

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ALINA Write for illustrated brochure and the address of nearest showroom.

ALINA CORPORATION

122 East Second Street, Mineola, Long Island, New York

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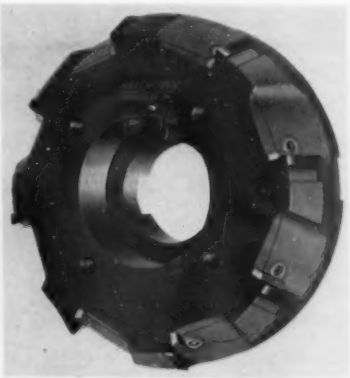
Positive Angle Milling Cutters

Positive angle cutters for milling with throwaway carbide inserts are usable in machines with limited horsepower, in jobs where thin sections are not suited to milling with negative angle cutters, for milling soft or stringy materials or where high finish is desired. Two-piece body construction permits the inserts

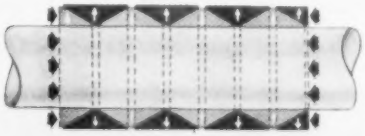


to nest on accurately ground surfaces in 60-deg body pockets, giving exact positioning and alignment and wide distribution of cutting pressures. Hardened anvils reinforce inserts and minimize cutter body damage. Inserts are wedge-locked, easily unlocked, and indexed quickly and accurately on the machine.

McCrosky Tool Corp., Meadville, Pa. **Circle 478**

Adjustable Bushings

Consisting of alternate male and female segments axially aligned, these adjustable wall-thickness bushings provide desired length by addition or deletion of segments. Half segments are used at the ends to provide a flat surface against which compressive force can be applied to make adjustment.



Length of the bushings is limitless; the shortest consists of one male and one female half segment. Segments can be slit three or more times.

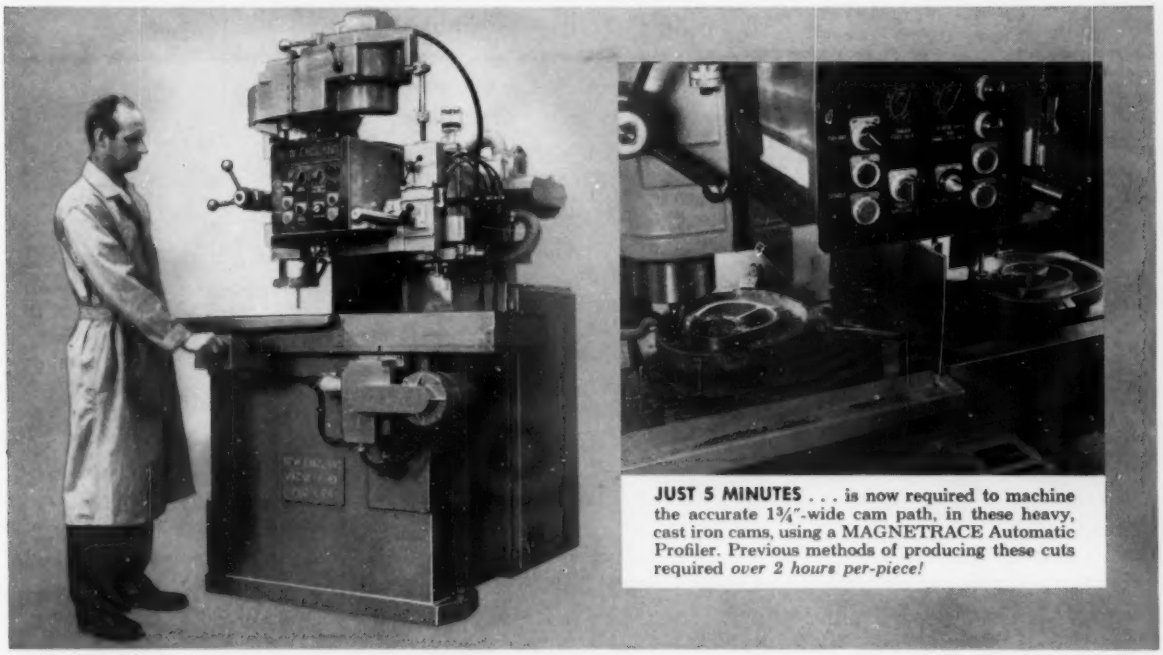
Bushings can be produced from aluminum alloy, oil-impregnated bronze, corrosive resistant steel, carbon steel or nonmetallic materials. Applications include use as structural fasteners, seals and plain bearings.

Adjustable Bushing Co., 12036 Vose St., North Hollywood, Calif. **Circle 479**

(Continued on page 290)

ACCURACY ASSURED...

...and complex contours produced at PLAIN-MILLING SPEEDS and FEEDS with



JUST 5 MINUTES . . . is now required to machine the accurate 1¾"-wide cam path, in these heavy, cast iron cams, using a MAGNETRACE Automatic Profiler. Previous methods of producing these cuts required *over 2 hours per-piece!*

the All-New MagneTRACE TRADE MARK Automatic Profiler

Designed, developed and built from the base up *specifically* for 360° profile milling under tracer control, the MAGNETRACE is compact, rigidly constructed, and has a powerful 7-speed spindle drive for fast removal of heavy metal. This powerful drive – plus the fact that the tracer follows the easily prepared steel template at a constant, preset feed up to 80 inches-per-minute – makes it possible to mill complex, irregular contours as fast as conventional machines produce plain-milling cuts. Many jobs ordinarily requiring roughing and finishing cuts are completed in a single pass. Finer finishes are obtained, and cutter life is greatly increased!

In addition, the extreme sensitivity of the unique MAGNETRACE tracer system (which requires a stylus deflection of only .0002" to activate the drive units), the complete elimination of backlash in the slide motions, and the overall precision and rigidity make it possible for the MAGNETRACE to produce copy milling with an accuracy comparable to that of precision, plain milling operations.

FOR COMPLETE INFORMATION

—see the MagneTRACE in operation at the A.S.T.E. Show in Detroit, Booth 2061 . . . or write now for 8-page Circular No. 635. Pratt & Whitney Company, Incorporated, 16 Charter Oak Blvd., West Hartford, Conn.

100th Anniversary 1860 1960

PRATT & WHITNEY ®

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MACHINE TOOLS • GAGES • CUTTING TOOLS

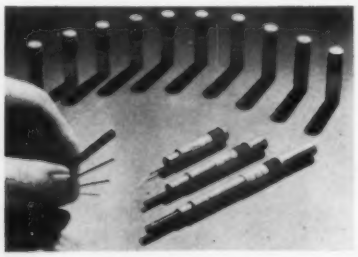
Mechanical Comparator

Accurate repeat readings are insured by this Mikrom comparator that completely eliminates friction, backlash and lag. Mechanical rather than electrical amplification makes the instrument immediately usable and completely portable. Carbide balls, backstop, lifting levers and zero adjustments can be provided. A removable table accomodates a 1½ x 3-inch platen with both flat and ribbed surfaces. Spindle-to-column and height capacities are both 4 inches.

Mueller Gages Co., 1052-1058 N. Allen Ave., Pasadena, Calif. **Circle 480**

Carbide Drill Blanks

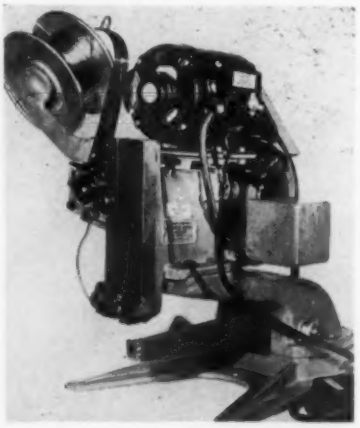
Solid carbide cutting tools in the 1825 Series of wire size drill blanks, numbers 1 through 30, are precision ground in grade C-2 to tolerances of + 0.0000-0.0005 inches. Diameter range is from 0.0135 to 0.2230 inch. Special blanks and grades are available.



Antrax Co., Newington, Conn. **Circle 481**

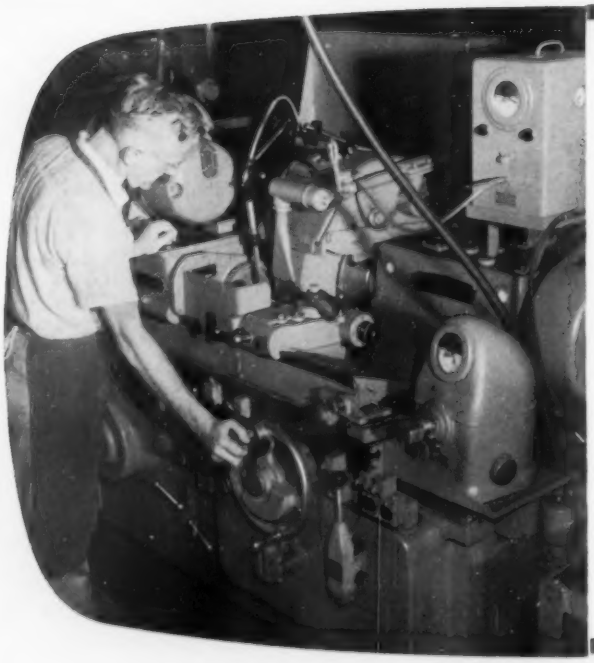
Portable Stapler

Wire staples are made and inserted in materials up to ⅜-inch thick by this portable wire stitching machine. It will staple through low-carbon steel, aluminum, plastics, wood and paper. A five-lb coil of wire provides approximately 60,000 staples. Foot or microswitch actuated, the machine has either a single or multitrip clutch. Both round and flat wire is stocked in 28 different gages.



General Staple Co., 28 E. 22nd St., New York 10, N. Y. **Circle 482**

ACCURACY ASSURED...



AIR-O-LIMIT* for Automatic Production Control

One of the nation's major home appliance manufacturers, Whirlpool Corporation relies heavily on Air-O-Limit Gages by Pratt & Whitney to combine speed, economy, and "tenths" precision in the production of vital compressor parts. Included are Air-O-Limit Automation Gaging Units that provide fully automatic control of product size. In the example shown here — an external grinder producing rotor shaft bearings — the grinding process is stopped automatically when work reaches the desired size. Scrap is practically eliminated, and bearings are dependably held to .0001" for size.

*REGISTERED TRADEMARK OF PRATT & WHITNEY COMPANY, INC.

100th Anniversary 1860 PW 1960

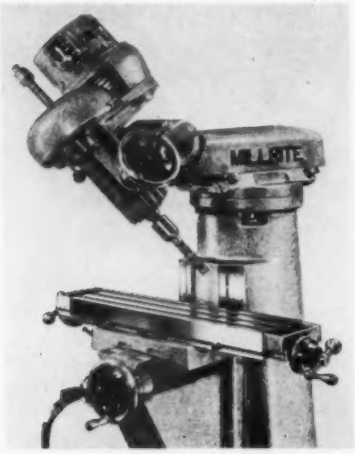
FIRST CHOICE FOR ACCURACY

PRATT & WHITNEY

Use Reader Service Card, CIRCLE 130

Compound Swivel Head

Increased range and capacity have been added to the U. S. Millright vertical mill through replacement of the original head by a compound swivel head. The swivel provides for double angle settings, facilitated by a protractor type scale. Recessed mounting of the swivel on the ram overarm minimizes overhang.

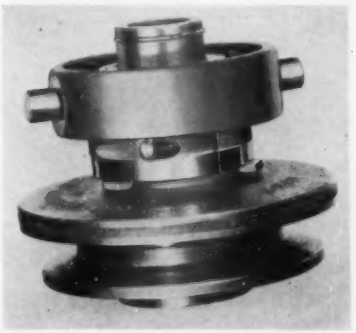


With the compound swivel overarm, throat distance (spindle to column face) is 17 in. max, 6½ in. min. Maximum distance from nose to table top is 18 in. Table feeds are longitudinal, 16 in., and crossfeed, 8 in. Vertical knee travel is 15 in., with ram movement of 12 in. and quill travel of 4 in.

U. S. Burke Machine Tool Co., Brotherton Rd. at Pennsylvania R. R., Cincinnati 27, Ohio. **Circle 483**

Small Disk Clutch

Types KB and KBB disk clutches have integral single or double V-belt sheaves mounted on double seal ball bearings. They are stocked in OD sizes of 4⅛, 4¾ and 5 inches. The clutches are for heavy-duty service on keyed-stub or through shafts from ⅝ to 1¼ inches in diameter, at speeds up to 4000 rpm. The units are engaged and disengaged with a manual shift lever.



Edgemont Machine Co., 2200 Home Ave., Dayton 17, Ohio. **Circle 484**

Finishing Broaches

Internal spur and helical gears and splines can be produced in one pass by full-form tools which combine a roughing broach and a removable shell type

finishing section. The broaches cut costs by as much as 50 percent by combining these operations. Finish-broached tooth surfaces are free of lines generated by conventional broaching.

National Broach & Machine Co., 5600 St. Jean, Detroit 13, Mich. **Circle 485**

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with PRATT & WHITNEY GAGES

. . . and for Parts Inspection

At Whirlpool, in-process and final inspections are complicated by the close tolerances involved and the fact that most parts must be checked on several critical dimensions. These problems are effectively solved by specially engineered Air-O-Limit Multi-Station Comparators like the typical example shown here. In a single operation, this comparator checks 8 separate tolerances, which include 5 different characteristics: size, taper, out-of-roundness, squareness, and concentricity. Gaging is fast and accurate; inspection costs are kept to a minimum and gaging bottlenecks are eliminated.

For more complete information on Air-O-Limit Gaging for your production machines or inspection lines, write today describing your operations and quality control requirements. Pratt & Whitney Company, Inc., 16 Charter Oak Blvd., West Hartford, Connecticut.

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530 exhibitors will be on hand to show and demonstrate more than 6,000 products . . . machine tools and attachments, precision control and inspection equipment, automation devices, cutting tools, dies, jigs and fixtures . . . everything, in fact, that's *new* in tools and tooling. It's your best opportunity to see, study, compare . . . under one roof, at one time . . . the most modern, scientific methods, processes and tools in metalworking.

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All of these scientific and educational attractions, and more, will bring more than 35,000 metalworking management, engineering and production men to the 1960 ASTE TOOL SHOW. Make sure you're one of them! Write or wire immediately for your rapid registration forms.

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TOOLS of today

Machinable Carbide

Ferro-Tic S, a machinable carbide in grades S-45 and S-55, is made in many shapes and sizes, either rough-turned or ground. Prepared by powder metallurgy techniques, the stainless steel-bonded carbide has unusual resistance

to corrosion and high temperature. The material can be turned, drilled, milled, sawed or otherwise machined. Applications include valves, gages, nozzles, forming rolls and bearings.

Sintercast Div., Chromalloy Corp., 132 Woodworth Ave., Yonkers 2, N. Y. **Circle 486**

Miniature Honing Mandrels

Honing mandrels and stones for bore diameters from 0.100 through 0.118 inch in increments of 0.002 inch are

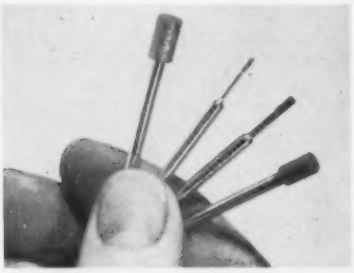
supplied in short-hole (K Series) and long-hole (BL Series) designs. Units illustrated have stone inserted for the 0.100 to 0.102-inch range.

Sunnen Products Co., 7910 Manchester Ave., St. Louis 17, Mo. **Circle 487**

Diamond Grinding Pins

Available in a wide range of sizes, with grit sizes of 200/240 and 80/100, diamond pins are suited for internal grinding of small holes, jig and other

grinding operations. Diamond grains are permanently bonded to the hardened tool steel shafts only, eliminating breakage.

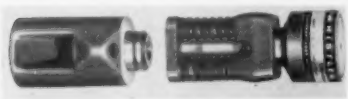


The pins are produced in cylindrical shapes with diameters of from 0.020 to 0.250 inch. The shaft is undercut for a length of 3/8 inch to provide clearance for pins smaller than the 1/8-inch shank.

Titan Tool Supply Co., 1419 Hertel Ave., Buffalo 16, N. Y. **Circle 488**

Punch, Die Retainer Units

Magnetic punch and die retainer units, smaller in over-all size than previous models, in many instances increase the number of holes that can be

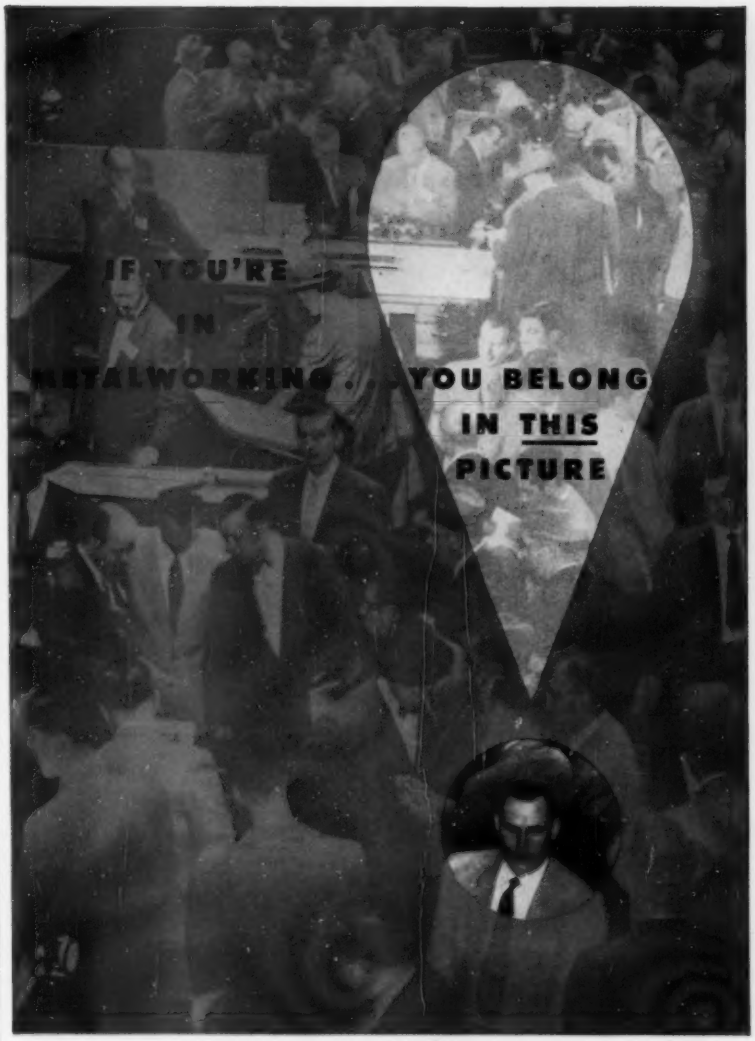


punched in one operation. The retainers can be used with all Magna-Die equipment. The punches are available in 0.001-inch increments, from 0.100 through 0.500-inch diam.

S. B. Whistler & Sons, Inc., 756 Military Rd., Buffalo 23, N. Y. **Circle 489**

Groove Location Gage

Accurate location of beveled and rectangular grooves is made possible with



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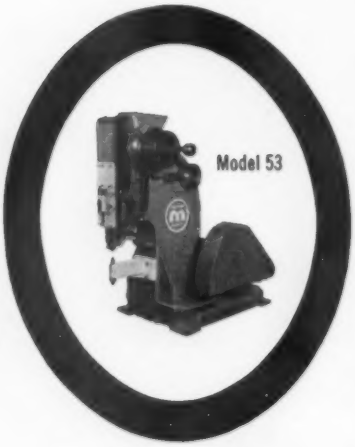
COST-CUTTING PRODUCTION TEAM!

. . . the two-way answer to assembly problems!



Here's a combination that cuts production costs and gets rid of assembly problems in a hurry—Milford Tubular Rivets made to high quality standards to assure a better finished product for you . . . Milford automatic rivet-setting machines that can be quickly adapted to your particular fastening needs. Write for more information on how you can put this team to work.

THE MILFORD RIVET MILFORD RIVET & MACHINE CO.

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the Truarc groove location gage. The tool measures the distance from the outer wall of a beveled or rectangular retaining ring groove to a plane of reference 0.4 to 1.4 inches from the groove wall.

The gage can be used for measuring location of O-ring grooves, rectangular oil grooves, thread reliefs and other internal recesses in bores and housings, and external grooves on shafts and similar parts. It will accommodate grooves in housings and shafts 1.5 inches in diameter or larger.

Waldes Kohinoor, Inc., 47-16 Austel Place, Long Island City 1, N. Y. **Circle 490**

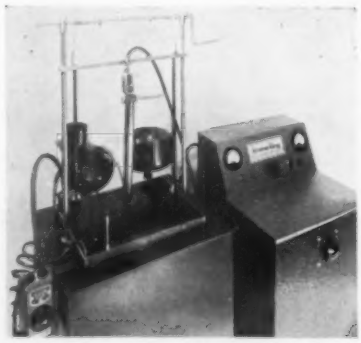
Perforating Punches

Fifty-eight specific point diameters are provided in a line of punches which conform to ASTME standards for heavy-duty head type tools. Shank diameters are within the fractional size range of 3/16 to 1 inch. The punches are recommended for making of tapping, clearance, rivet or stud holes. Additional point sizes are supplied for plating allowance, slip or press fit of mating parts and high-limit sizing of open tolerance holes.

Dayton Perforators, Inc., 1336 Stanley Ave., Dayton, Ohio. **Circle 491**

Electroplating Units

Setup and stopoff time are reduced in a series of three models by an electroplater attachment consisting of a hoist which raises and lowers a plastic coated table into a self-controlled hard chrome plating solution. The table holds parts



and acts as a current deflector, preventing buildup on the ends and edges of parts being plated. Tank size of the K-100 model illustrated is 12 x 15 x 18 inches.

Krome-King Div., National File Co., 530 N. Cedar St., Lansing 12, Mich. **Circle 492**

Plastic Planking

Designed to replace mahogany and impregs as a pattern and model making material, plastic planking eliminates waste due to warpage, grain and knots of conventional materials. The planks are supplied in standard lumber sizes of 1 x 6 ft and in thicknesses of 2 and 2½ inches. Shorter lengths can be ordered. Density of the material is 36 to 44 lb per cu ft. It can be carved, sawed, chiseled, planed or shaped with conventional wood working tools, has high impact resistance and uniformity.

Ren Plastics, Inc., 5422 S. Cedar Rd., Lansing 9, Mich. **Circle 493**

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Size-Au-Trol*

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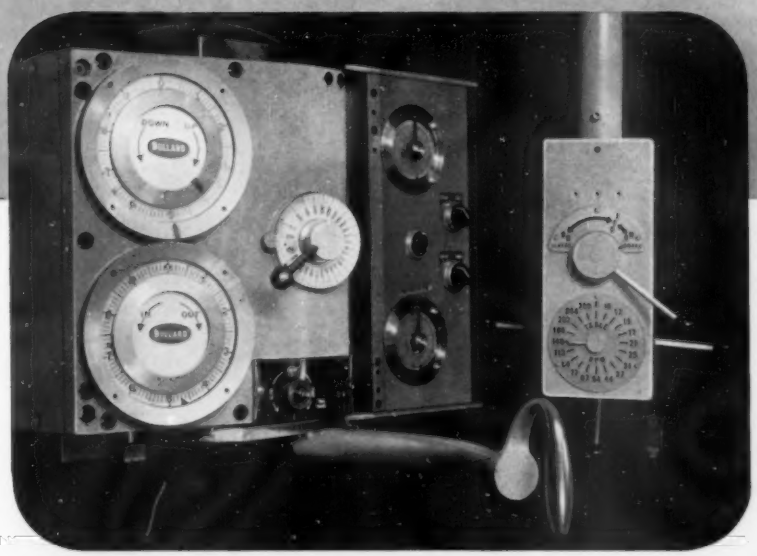
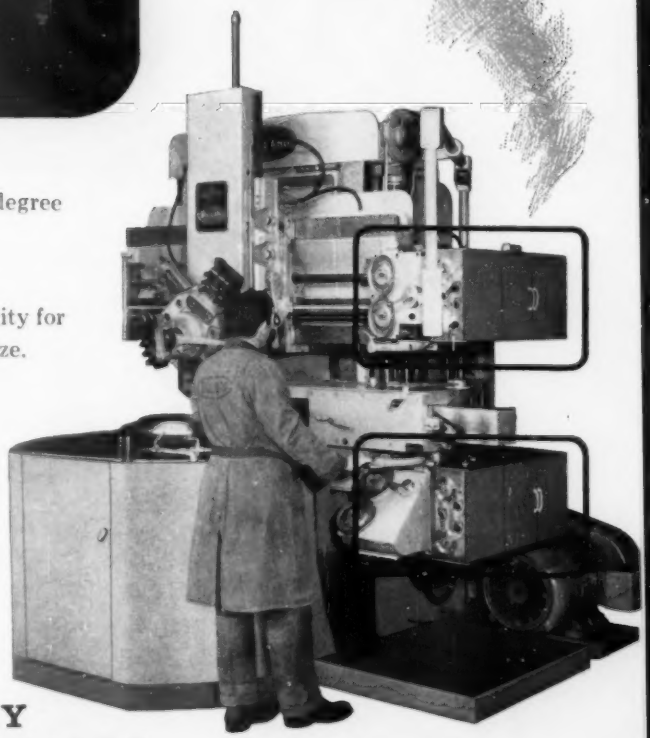
Bullard DYNATROL*

VERTICAL TURRET LATHES





Size-Au-Trol* provides precise tool positioning control to a degree unobtainable with other vertical turret lathes.

Size-Au-Trol* after set-up relieves the operator of the responsibility for sizing the work by insuring consistent control of size.

Size-Au-Trol* repetitively accurate to within .0003, increases productivity by cutting time between cuts.

Size-Au-Trol* is standard equipment on the complete line of Bullard Dynatrol V.T.L.'s.

For information on the completely new Dynatrol* line of vertical turret lathes, contact your nearest Bullard Sales Representative or write

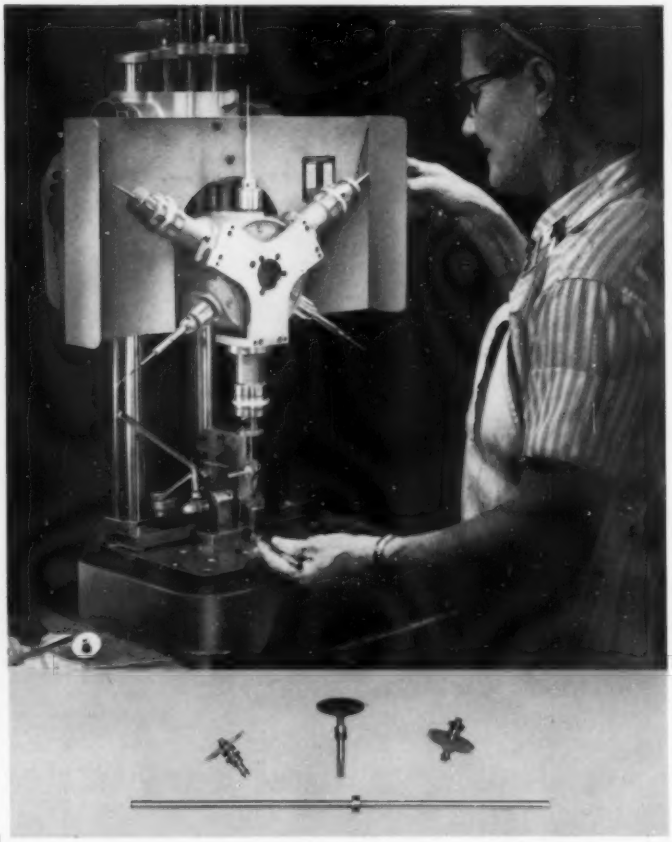
THE BULLARD COMPANY
BRIDGEPORT 9, CONNECTICUT

*Trademark

. . . YOU CAN'T BEAT A BULLARD . . .

Librascope buys 16 Burgmaster Bench Model Turret Drills . . .

steps up production 400%



6 Spindles In 1/3 Floor Space

The Librascope Division, General Precision Inc. of Glendale, California is making record savings in machining precision parts with Burgmaster Bench Model "O" 6 Spindle Turret Drills. After an original purchase of two machines, consistent savings in machining time led to further purchases totaling 16 Burgmaster Turret Drills.

Gear Shaft Assemblies for Fire Control Computers were formerly machined with a single spindle drill, production time was 2.50 hours per lot of 15 parts. The Bench Model Burgmaster now does the same operations on a lot in .50 hours, an increase of 400%.

Savings like this are possible because of POWER INDEXING of the turret rapidly performs up to six operations at operator command without tool changing and with minimum operator exertion and shifting of fixtures. Fine finish and accuracy are further assured by a sensitive feed handle, and **preselective speed** and **depth control** for each spindle. Tapping is readily performed.

JOB FACTS

Company: Librascope Division, General Precision Inc.
Machine: Burgmaster Bench Model "O" 6 Spindle Turret Drill.
Parts: 3 Stainless Steel Gear Shaft Assemblies
Lots: 15 parts average.
Holding: Manual clamping centering fixture.
Former Time and Method: 2.50 hrs. per 15 lot on Single Spindle Drill. Tool change required on every setup.
Present Time: .50 hrs. per 15 lot, an increase of 400%.
Operations: Part 1—Drill #54, ream .0625 thru for 1/16 spring pin.
Part 2—Drill #52, taper ream 6/0 for taper pin.
Part 3—Drill #55, taper ream 7/0 for taper pin.
Advantages: Increase Production 400%—Occupies 1/3 the floor space—tool changing reduced to minimum—less operator fatigue—greater flexibility.

Three different Gear Shaft Assemblies are precision drilled and reamed using a single tool setup. Drill location accuracy is assured by a hand-clamped centering fixture and the retracting drill guides bolted to the turret head which support and guide the drills.

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Trade Literature

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TRANSFER MACHINES, production units, programming machines, standard drills, honing machines and coolant cleaning equipment are described and illustrated in eight-page bulletin GC-60. Barnes Drill Co. **(Circle 301)** . . . Power tool catalog No. 60 is a 44-page presentation of the manufacturer's standard and Golden Anniversary models. Boice-Crane Co. **(Circle 302)** . . . A 34-page brochure covers flexible shafting, flexible shaft machines, handpieces and accessories. Jarvis Corp. **(Circle 303)** . . . A new approach to leasing arrangements for machine tools is described in a four-page brochure. Jones & Lamson Machine Co. **(Circle 304)** . . . A line of machine tools, including mills, drilling machines and lathes with a choice of controls, is described in catalog No. 60. Giddings & Lewis Machine Tool Co. **(Circle 305)** . . . Numerous design hints and recommendations for engineers and designers are offered in technical booklet No. 4 on mechanical breadboard components for instrumentation development. PIC Design Corp. **(Circle 306)** . . . "Design and Purchasing Manual" has 140 pages on miniature and instrument ball bearings, with 22 engineering bulletins and specifications on 370 bearings. New Hampshire Ball Bearings, Inc. **(Circle 307)** . . . Engineering-related progress and achievements of the past year are reviewed in a 36-page, illustrated annual edition of "Engineering in Action." Industries Div., Allis-Chalmers Mfg. Co. **(Circle 308)** . . . "Who Gets Hurt (in industrial accidents)?" uses a humorous approach, color cartoons and precise text to discuss on-the-job injuries. National Safety Council. **(Circle 309)**

Boring, Drilling, Tapping

Small single and double-end boring machines are described and illustrated in a folder that also covers various spindle setups and equipment. Ex-Cell-O Corp. **(Circle 310)** . . . Bulletin AD-1222 illustrates and provides catalog listings of a radial drill press. Rockwell Mfg. Co. **(Circle 311)** . . . Air and hydraulic drill press feeds and air-powered tapping and drilling machines are covered in eight-page, pictorial catalog No. F-60. Beckett-Harcum Co. **(Circle 312)** . . . Information is cross-referenced in charts in a 28-page booklet on tap selection. The Hanson-Whitney Co. **(Circle 313)**

Cleaning

Use of shot and grit abrasives in blast cleaning is detailed, and new products, materials, standards, specifications and analysis discussed, in a 30-page booklet. National Metal Abrasive Co. **(Circle 314)** . . . Utrasonic equipment for cleaning flat and convoluted metal filter element surfaces is described in a technical paper. Aircraft Porous Media, Inc. **(Circle 315)**

Drafting Materials

Over 2000 AG tapes, templets, grid sheets, die cut symbols, numbers and letters are listed in a 32-page catalog. Applied Graphics Corp. **(Circle 316)**

Electrical & Electronic Components

Solid state magnetic switching for automated industrial process controls is covered in an eight-page brochure on a static time sequencer. Magnetic Amplifiers, Inc. **(Circle 317)** . . . Two-page data sheet 168 details a center neutral plug-in limit switch. Micro Switch Div., Minneapolis-Honeywell Regulator Co. **(Circle 318)** . . . Drawing templates on tht Model M limit switch are available, without cost, for full and half-scale reproduction. R. B. Denison Mfg. Co. **(Circle 319)**

Electrodeposition

"Current Uses for Electroforming" is a 32-page technical handbook for designers, engineers and manufacturers. Allied Research & Engineering Div., Allied Record Mfg. Co. **(Circle 320)**

Fasteners

Specifications and application information on self-locking inserts and tapped holes is presented in an eight-page catalog. The Boots Corp. **(Circle 321)** . . . Blind rivets are detailed in an eight-page, illustrated catalog. "Pop" Rivet Div., United Shoe Machinery Corp. **(Circle 322)** . . . Fatigue life control of threaded fasteners is reported in a 32-page design manual, No. 5930. Elastic Stop Nut Corporation of America. **(Circle 323)** . . . "Root of the Thread" is an illustrated, 20-page coverage of tension bolt and screw thread root problems. Standard Pressed Steel Co. **(Circle 324)** . . . A complete line of fasteners is presented in an illustrated 24-page catalog. Huck Mfg. Co. **(Circle 325)**

Finishing & Grinding

"Designing for Chromallizing" is the subject of an illustrated, two-page data sheet. Chromalloy Corp. **(Circle 326)** . . . Uses for rubberized abrasives, methods of application, case histories and a product catalog are combined in an application manual. The Cratex Mfg. Co. **(Circle 327)** . . . Four technical bulletins offer information on barrel finishing operations. Tumb-L-Matic. **(Circle 328)** . . . An expanded line of wheels, drums, belts and cones for polishing and sanding are described in literature and catalogs. Nu-Matic Grinders Inc. **(Circle 329)** . . . Two models of reciprocating tool grinders are described in a four-page, illustrated bulletin 465927. Ex-Cell-O Corp. **(Circle 330)** . . . Specifications, photos and other details of grinding spindles are presented in bulletin DM 59. The Dumore Co. **(Circle 331)** . . . Bulletin M-60 illustrates and describes a mechanical microswivel for table adjustments on cylindrical grinders. Landis Tool Co. **(Circle 332)** . . . Quills available for the company's grinding machines are listed with information on wheel binder screws and special wrenches in a 16-page catalog. Bryant Chucking Grinder Co. **(Circle 333)**

Fluid Power

Bulletin P2547P covers air, hydraulic and adjustable stroke cylinders, piston rods, cushions, booster, circuits and pipe thread fittings in 24 illustrated pages. Flick-Ready Corp. **(Circle 334)** . . . Two 12 and 16-page illustrated catalogs

cover industrial metal hose and synthetic hose and fittings. Industrial Hose Div., Flexonics Corp. **(Circle 335)** . . . An electrohydraulic industrial servo valve is detailed in bulletin 59-74 and a second brochure (VEL 101) gives application information on a building block velocity system. Vickers Inc. **(Circle 336)** . . . Flexible couplings are illustrated and described in 60-page engineering catalog No. 60. Thomas Flexible Coupling Co. **(Circle 337)** . . . Large and small bushed and spacer couplings are presented in bulletin No. 5103. T. B. Wood's Sons Co. **(Circle 338)** . . . New models of hydraulic check valves for in-line mounting are presented in catalog sheets 1562A14 and A15. Parker-Hannifin Corp. **(Circle 339)** . . . A 72-page catalog gives design details and operating characteristics of a line of hydraulic pumps, fluid motors and valves. Dennison Engineering Div., American Brake Shoe Co. **(Circle 340)** . . . Bulletin supplement S-113-1A covers advantages of straight thread cylinder ports. Power Cylinder Div., Hannifin Co. **(Circle 341)**

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Heat-Treating, Brazing, Soldering

Induction equipment for automated metal heating is described in an illustrated folder. Robotron Corp. **(Circle 343)** . . . Facts and specifications on electronic, motor generator, high and low frequency induction heating equipment are presented in illustrated, 56-page catalog D3-2. Induction Heating Corp. **(Circle 344)** . . . Bulletin No. 151 describes and illustrates graphite "continuing" electrodes in high and low temperature salt bath furnaces. Salt Bath Furnace Div., Lindberg Engineering Co. **(Circle 345)** . . . Illustrated data sheets NAV 20-14-2 and 3 describe the use of scale preventative coatings during heat treatment of metals. Navan Products, Inc. **(Circle 346)**

Inspection and Measurement

Publication No. SPG-169 is a comprehensive handbook on dimensional air gaging. The Sheffield Corp. **(Circle 347)** . . . A 16 mm sound, color film available on a free loan basis, presents a 42-minute discussion and demonstration of dimensional gaging with air. Federal Products Corp. **(Circle 348)** . . . Proving rings and a calibration press are illustrated and described in four-page bulletin P-260. Steel City Testing Machines, Inc. **(Circle 349)** . . . Thread comparator and gage applications and procedures are presented in an illustrated, 18-page thread gaging catalog. The Johnson Gage Co. **(Circle 350)** . . . A number of charts and illustrations are included in a 24-page catalog and manual on plug and ring gages. Regal Div., Beloit Tool Corp. **(Circle 351)** . . . Bulletin LT14 presents eight-pages of information on surface finish measurement. Micrometrical Mfg. Co. **(Circle 352)** . . . The first in a series of technical papers for the advancement of metrology, "Penta Prism Behavior in Optical Tooling Techniques" is a 20-page, illustrated presentation of the behavior of this instrument in its various applications and changes of position and alignment. Engis Equipment Co. **(Circle 353)**

Lubrication and Cooling

In 24 illustrated pages, bulletin 26-T describes the principles of operation

and system components of a line of centralized systems of lubrication. Farval Div., Eton Mfg. Co. **(Circle 354)** . . . Detailed information on operation, application and GPM capacities of coolant filters is presented in an illustrated bulletin. Hydromation Filter Co. **(Circle 355)**

Materials

Two engineering bulletins provide basic information on two high-temperature industrial laminated plastics available in sheet, strip and tube form. Synthane Corp. **(Circle 356)** . . . Technical data bulletin No. 3.1.8.2. describes a hot-punch copper-clad laminate. Taylor Fibre Co. **(Circle 357)** . . . Ceramic fibre that withstands operating temperatures up to 2300 F is treated in an eight-page brochure that lists properties, available forms and current uses. The Carborundum Co. **(Circle 358)** . . . "Aluminum Pig and Ingot" is a 12-page aid to selection of aluminum alloys for use in production of castings. Aluminum Company of America. **(Circle 359)** . . . Extruded aluminum bronze, available in two alloys, is described in a six-page brochure with which test samples are offered. Meier Brass & Aluminum. **(Circle 360)** . . . Preliminary technical data on Unimach UCX2, a AISI 4100 series type steel modified through the addition of cobalt as an alloying element, is introduced in a 20-page booklet heavily illustrated with graphs and charts. Universal-Cyclops Steel Corp. **(Circle 361)** . . . Technical data sheets 501 through 507 provide information about alloys available in rod, bar, strip, foil and wire form. Precision Metals Div., Hamilton Watch Co. **(Circle 362)** . . . Fast-machining cold finished steel bars and cold drawn sheet tubing are covered in technical bulletin 12-10. Joseph T. Ryerson & Son, Inc. **(Circle 363)** . . .

Milling

Milling machine arbors and adaptors with live bearing supports are described in an illustrated folder. J & S Tool Co. **(Circle 364)** . . . Multiple thread milling cutters and fine pitch gear hobs are detailed in 12-page, illustrated technical catalog CH-1. The Hanson-Whitney Co. **(Circle 365)**

Numerical Control

A 20-page guide book contains basic information and approximate costs of tape control for machine tools in metalworking industries. Ex-Cell-O Corp. **(Circle 366)** . . . Bulletin J-105 contains 16 illustrated pages of information about a variety of positioning and program controls. Jordan Controls, Inc. **(Circle 367)**

Parts Handling

A line of units for the automatic elevating-feeding and orienting of parts is described in a four-page folder, No. 2812. Detroit Power Screwdriver Co. **(Circle 368)** . . . Small, heavy and extra-heavy-duty vibratory feeders are described and illustrated in a 32-page catalog. Syntron Co. **(Circle 369)** . . . Permanent and special-design magnets for use in conveyor systems are described in a series of leaflets, "Magnet Ideas." Use of magnets in conveyor systems eliminates need for hooks. Empire Magnetics, Inc. **(Circle 370)**

Presses and Pressworking

A line of multiple-application presses and accessories is described in 24-page bulletin No. 120. Denison Engineering Div., American Brake Shoe Co. **(Circle 371)** . . . Straight side, single action, hydraulic presses are detailed in eight-page bulletin 5B. K. R. Wilson, Inc. **(Circle 372)** . . . "Maintenance of Unitized Tooling" is a 20-page manual, written by Ray I. Smith, Jr., industrial engineering supervisor of the Butler Mfg. Co., for users of all types of punches and dies. Punch Products Corp. **(Circle 373)**

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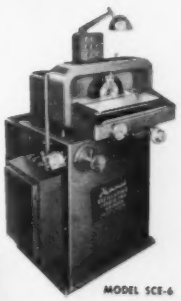

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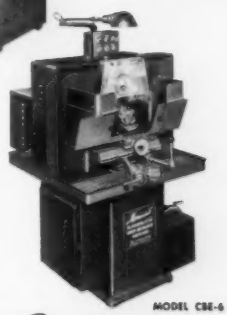

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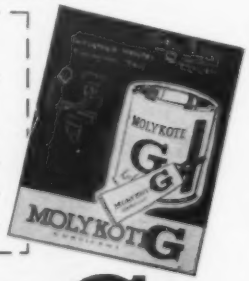

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Tooling

Catalog No. 30 covers jig and fixture components, including quick-acting hand knobs and inserts. Northwestern Tools, Inc. **(Circle 375)** . . . A dowel pin assortment kit is described in a data sheet. The Producto Machine Co. **(Circle 376)** . . . More than 70 products, including vises, plates, tables and lathe milling attachments, are described and illustrated in 18-page, pocket-sized catalog No. P100. Chicago Tool and Engineering Co. **(Circle 377)** . . . Twelve-page catalog 1960 covers a multipurpose workholder, hand tappers and accessories, master angle plates, a sine bar and a tap and die guide. Lassy Tool Co. **(Circle 378)**

Turning

Detailed data on a line of heavy-duty engine lathes is available in technical literature. Nebel Machine Tool Corp. **(Circle 379)** . . . Four-page bulletin 160 provides specifications of live centers designed for standard and special-purpose applications. Sturdimatic Tool Co. **(Circle 380)** . . . Bulletin HC-HCT gives complete information on a line of precision chucking machines. Hardinge Brothers, Inc. **(Circle 381)**

Welding, Soldering, Brazing

Resistance welding data is presented on a colorful, metal-edged, 20½ x 29½-inch wall chart, RW-5. Ampco Metal, Inc. **(Circle 382)** . . . Operating data for a carbon dioxide welding process is contained in brochure NH-636. National Cylinder Gas Div., Chemetron Corp. **(Circle 383)** . . . A 12-page reprint of a paper prepared and presented by A. B. Wilder and E. B. Henry, Jr., National Tube Div., U. S. Steel Corp., is titled, "A Progress Report on Continuous Fluoroscopic Inspection of Submerged-Arc Welded Line Pipe." Philips Electronic Instruments. **(Circle 384)** . . . Fifty-two page, illustrated bulletin GEA-3193C offers information on how and where to use electric furnace brazing. General Electric Co. **(Circle 385)** . . . A miniature, low tension soldering iron is presented in an illustrated data sheet. Caig Laboratories. **(Circle 386)**

who's meeting and where

Apr. 3-6. National Screw Machine Products Assn. 1960 national business meeting, Ambassador Hotel, Los Angeles, Calif.

Apr. 3-8. Sixth Nuclear Congress and Atomic Exposition, New York Coliseum.

Apr. 4-8. Southwest Research Institute and Society for Experimental Stress Analysis. Short course in strain gage techniques. Additional information available from Dr. M. M. Lemcoe, Southwest Research Institute, P. O. Box 2296, San Antonio, Tex.

Apr. 7-8. The Galvanizers Committee and American Zinc Institute. Forty-first meeting, Chase and Park Plaza Hotels, St. Louis, Mo.

Apr. 13-14. Malleable Founders Society. Market Development Conference, Edgewater Beach Hotel, Chicago, Ill.

Apr. 18-19. ASME, IRE and AIEE. Third Annual Conference on Automatic Techniques, Cleveland-Sheraton Hotel, Cleveland, Ohio.

Apr. 21-28. ASTME. Twenty-eighth Annual Engineering Conference and Exhibit, Sheraton-Cadillac and Statler Hilton Hotels, Detroit, Mich.

Apr. 21-28. ASTME. Tool Show, Artillery Armory, E. Eight Mile Rd., Detroit, Mich.

Apr. 24-May 3. German Industries Fair, Hanover, Germany, Information available from the German American Chamber of Commerce, 666 Fifth Ave., New York 19, N.Y.

May 9-12. Instrument Society of America. Instrument-Automation Conference and Exhibit, Civic Auditorium and Brooks Hall, San Francisco, Calif.

May 9-13. American Foundrymen's Society. 1960 Castings Congress and Exposition, Convention Hall, Philadelphia, Pa.

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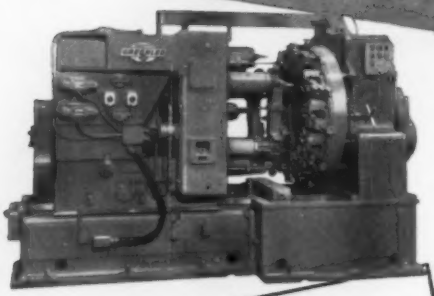

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Russian Cutter Geometry

Tool geometry recommended in the USSR for straddle mills with inserted carbide or high-speed tool blades is covered by H. J. Burmeister in an article entitled "Konstruktion und Einsatz neuzeitlicher Scheibenfraeser mit HSS bezw. Hartmetall Schneiden." The article, which is based on data from Russian magazines, appears in *Technisches Zentralblatt fuer praktische Metallbearbeitung*, Vol. 53, Nos. 8-9, 1959, p. 287 ff.

It is claimed that Russian tool engineers were the first to have found the improvements in metalcutting performance made possible by increasing the true rake angle, both for up and down milling. In the case of cast iron and nonferrous metals, a true rake angle of 12 deg is recommended in combination with a clearance angle of 10 deg and a 12 to 20-deg angle of inclination. (The wide range for the angle of inclination indicates—in this writer's opinion—either a variation in the corner angle or a different concept of the geometrical relationships involved.)

For the milling of steel less than 70,000 psi tensile strength, a true rake of 25 deg is recommended, decreasing to 20 deg for steel with a tensile strength of more than 140,000 psi. These angles are used for high-speed steel cutters, while only +5-deg true rake and +15-deg clearance angle are recommended for the milling of cast iron with carbide cutters. The low-strength steel (70,000 psi) should be milled with a carbide cutter of zero-deg true rake, decreasing to a negative true rake of 20 deg for the high-strength steel, again in combination with a clearance angle of 15 deg.

Two basic conclusions are made concerning the clearance angle: first that it should be much larger than in conventional practice (depending on the

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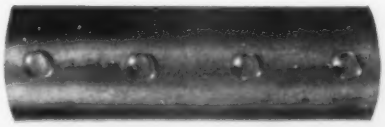

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thickness of the undeformed chip) and second that the included angle (between face and flank) need not be taken into consideration. Hence, a large true rake is also advantageous if the included angle becomes rather small due to a large clearance angle.

Cutting speeds for the milling of low-tensile steel with high-speed steel tools should be 200 fpm for a feed per tooth of 0.008 inch. The cutting speed can be increased to about 725 fpm when using carbide tools and a feed per tooth of 0.010 inch. (These data appear to be very general in view of the fact that the depth of cut is not included.)

Bruenn Exhibition

A machine tool exhibition held for the first time at Bruenn, Czechoslovakia, behind the Iron Curtain, is described in an article by M. Seybold in *Zeitschrift des Vereins Deutscher Ingenieure*, Vol. 101, No. 34, 1959, p. 1657 ff. It is entitled "Werkzeugmaschinen auf der ersten internationalen Messe Zu Bruenn."

About 30 countries showed their latest products, which included machine tools and other machinery. The halls covered about 700,000 sq ft, the open space about 650,000 sq ft. Machines from Russia, China, Poland and other nations in the Russian bloc were shown.

The lathes on exhibit included all types from bench lathes up to lathes with 80-inch swings and center distances up to 36 feet.

One of the universal lathes exhibited has a 14.6-inch swing, spindle speeds up to 2800 rpm and is equipped with plain spindle bearings for radial loads and ball bearings for axial loads, like the German Kaerger lathe.

Also exhibited was a production lathe having high vibratory stiffness, which runs at speeds up to 2240 rpm and can be used for workpieces up to 22 inches in diameter. This machine is equipped with a hydraulically operated tailstock.

Punch card programming can be used on a semi-automatic copying lathe with 15 spindle speeds between 112 and 2240 rpm. (Spindle rpm are standardized in Europe—on both sides of the Iron Curtain, hence the occurrence of 2240 rpm on the last two machines discussed.) The maximum torque is 740 ft-lb for the 15-hp machine.

A vertical boring mill exhibited at Bruenn can be used to machine workpieces up to 54 inches in diameter. Facing operations can be performed at constant surface speeds due to a 1:4

infinitely variable speed drive in conjunction with a gear transmission. Spindle speeds cover a range from 3.55 to 140 rpm. The machine is equipped with an electromagnetic copying attachment at the left-hand slide on the cross rail. Maximum horsepower is 37 and rapid traverse is possible at 55 ipm.

Stepless spindle speeds are a main feature of a horizontal boring mill of 37 tons weight with an arbor of 6.4 inches diameter. The machine is equipped with a d-c motor and Ward-Leonard transformer. The spindle speed range is from 2 to 800 rpm.

Technical Handbook

A new edition of *Klingelberg, Technisches Hilfsbuch* has been published by Springer-Verlag Berlin. The book is edited by F. Pohl and R. Reindl in cooperation with numerous other contributors. It contains 863 pages of about 4 by 6 inch size. The price is 21 Marks (about $5.00).

A 52-page mathematical section covers elementary relationships, which can readily be understood even by readers whose knowledge of German is somewhat rusty.

Measuring systems and metric-English conversion tables are discussed and the introduction into the metric system of the kilopond is explained. This unit indicates force. Kilogram units are now reserved for mass.

The third chapter deals with moments of inertia, modulus of elasticity in the metric system, hardness, shear strength and similar quantities, including radioactive isotopes.

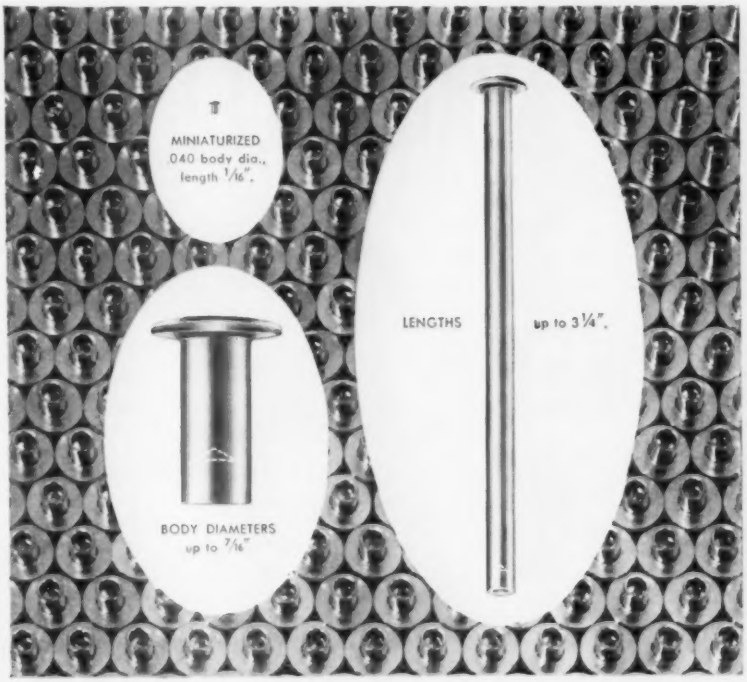
A very good chapter covers the European work materials, both metals and wood. The analyses of German standard steels are listed and also those of nonferrous metals. A table of carbide tools completes this chapter.

Other chapters deal with machine design considerations such as fits, screws, springs, threads, measuring tools. German standards for spindle revolutions, dimensions of letter-heads and similar standards of considerable value conclude the book.

Russian Transfer Machines

Methods used in USSR for the hydraulic operation of transfer machines are discussed in an anonymous article in *Zeitschrift des Vereins Deutscher Ingenieure* for January 11, 1960. A number of hydraulic devices are described. These are used for purposes such as automatic transfer mechanisms, distributors, control panels, devices for checking the dimensions of holes before tapping and others.

Look at this Size Range of Semi-Tubular Rivets... it's the way to lower cost



Miniaturized components and also large complete assemblies can now have all the money-saving advantages of using single and multiple automatic riveting. This is due to the wider size range of semi-tubular rivets now available and which can be used in conjunction with motor and pneumatic driven automatic riveting machines.

Today, there is hardly a fastening problem, involving even fragile materials, that does not warrant consideration of low-cost semi-tubular rivet setting.

Our Factory Riveting Specialists are ready to help you obtain the REAL COST FACTS on your own specific fastening problem. There is no obligation.

FOR YOUR FILES
Chicago Rivet Catalog describes 1388 standard tubular and split rivets and 25 single and multiple automatic rivet setters.

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P-K® SOCKET SCREWS WITH LONG-LOK® INSERTS

Provides high resistance to shock and vibration.

Assures superior thread engagement and locking force.

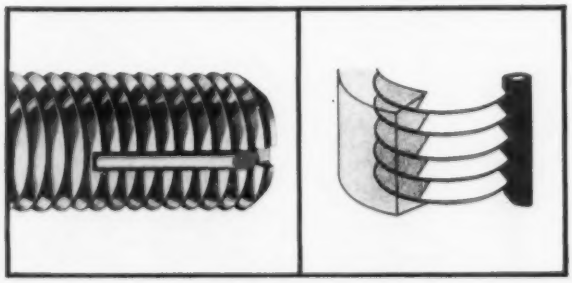
Permits high reusability.

Eliminates lock washers and safety wire.

WHAT IS LONG-LOK?

Long-Lok is an insert which becomes an integral part of the P-K Socket Screw in which it is used. A root-deep axial slot is milled into the external threads of any of the various types of P-K Socket Screws and permanently filled with a specific material engineered for the design application. In use, the insert provides triple locking action: (a) axial tolerance is taken up by the resilient insert material, causing metal-to-metal "drag", (b) radial tolerance is taken up because the side opposite the insert is forced into close contact for additional metal-to-metal "drag", and (c) torsional resistance of the insert itself.

The fastener is easily inserted and started because of the tapered end of the insert. The length of the insert assures full engagement of the locking material and a radial load on mated threads.



In locking and anchoring applications, the insert assures a radial load on mated threads which results in increased contact friction at the thread flanks. Under operating conditions, the friction then prevents relative motion between the mating threaded parts. In sealing applications, the insert is selected and processed to result in a dam which prevents the flow of gas or liquid along the thread helix. Axial of a fluid or gas is prevented by a uniform annular flank-to-flank contact of the mating thread pitches.

HERE ARE SOME OF THE ADVANTAGES!

P-K Socket Screws with Long-Lok Inserts speed-up and improve reliability of assembly operations. The P-K Socket Screw with Long-Lok is not dependent upon seating operations, locking securely wherever installation torque stops. Long-Lok inserts span temperature ranges from —320°F to +1200°F as required; pass through normal clearance hole with ease and install easily because torque forces build up smoothly and gradually all the way.

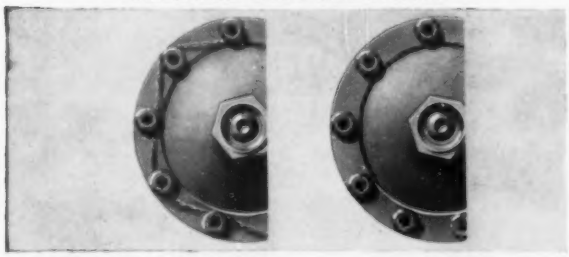
The Long-Lok insert does not protrude, thus P-K Socket Screws with Long-Lok inserts pass through normal clearance holes with finger pressure. No special clearance holes are required. Normal handling or installation will not dislodge inserts.

P-K Socket Screws with Long-Lok inserts make possible a long range of adjustment, and because of the extremely low "cold flow" and exceptional "memory" of the insert material, insure a high degree of reusability. Insert material does not project beyond the basic diameter of the fastener and the slot does not present an abrupt change of section to operating loads. What's more, the small cross sectional area of the insert has no effect upon fatigue strength and does not reduce basic rated tensile strength of the unit.

WHERE SHOULD LONG-LOK BE USED?

In industrial and consumer products—tools, machines, appliances—wherever vibration is present—wherever adjustment may be required—wherever re-use is a factor—wherever the needs of quality control in production are exacting . . . P-K Long-Lok fasteners may be the right answer. In the electronics industry, in engines, hydraulics, valves, optical instruments—even in guided missiles—Long-Lok is building an enviable reputation for reliability.

TIME AND COST REDUCTION



Critical weight and needless man-hours of assembly time can be saved through the use of P-K Socket Screws with Long-Lok inserts. The fasteners are heat, impact, shock and vibration resistant. They completely eliminate the need for intricate and costly safety-wire installations.

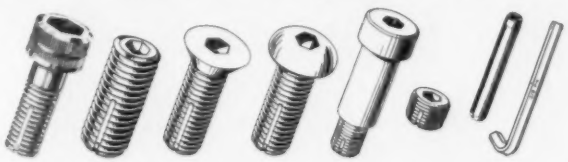
In the aircraft industry, fasteners with Long-Lok inserts are an exciting advance—opening up new, faster, safer design opportunities—doing away with costly, intricate safety-wiring operations—resulting in fastenings that stay tight and secure under punishing vibration—under every environmental attack. Long-Lok fasteners are already in use in supersonic applications and meet the requirements of #MIL F 18240A (ASG) and NAS1081 specifications,

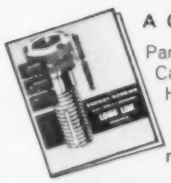
In the automotive industry, P-K Socket Screws with Long-Lok inserts will meet every requirement for efficiency and reliability. As an adjustment screw, this new fastener can offer superior performance and in many cases the efficiency of the insert can act as a barrier against fluid leakage, eliminating the need for messy sealing compounds.

HOW IS THE LONG-LOK FURNISHED?

Parker-Kalon Socket Screws with Long-Lok inserts are available in socket head cap screws, set screws, flat head, button head, shoulder screws and pipe plugs. They will be stocked by your P-K Distributor in a range of popular sizes with Polycap (green) inserts. Polycap is a nylon type polymer capable of performing within a temperature range of −120°F to +250°F and recommended for general applications, thread-sealing applications and applications requiring frequent adjustment.

On order, Parker-Kalon will supply Socket Screws with Long-Lok BLUE-KEL-F® inserts, a thermoplastic with zero water absorption for −120F° to −320°F, and for +250°F to +390°F. For use where temperature requirements range between +400°F and +1200°F, Parker-Kalon will furnish Socket Screws with Long-Lok metallic inserts.





A COMPLETE LINE

Parker-Kalon offers a complete line of Socket Head Cap Screws, Shoulder Screws, Button Heads, Flat Heads, Set Screws, Hex Keys and Key Kits, Dowel Pins and Pipe Plugs, as well as the P-K Pre-Lode (1960 Series) Socket Head Cap Screw and the revolutionary new P-K W-Point Socket Set Screw.

SAMPLES AND TECHNICAL DATA MAY BE OBTAINED FROM YOUR P-K INDUSTRIAL DISTRIBUTOR, OR AT THE A.S.T.E. SHOW IN DETROIT—BOOTH 1642.

PARKER-KALON®
Socket Screws

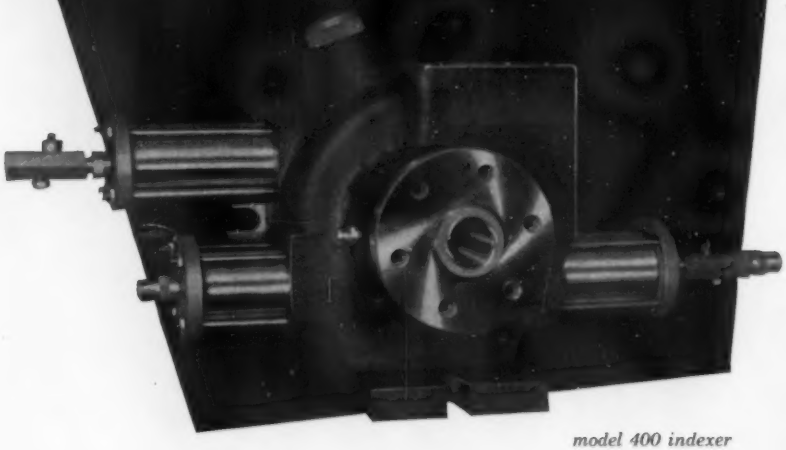
PARKER-KALON, a division of General American Transportation Corporation, Clifton, New Jersey · Offices and warehouses in Chicago and Los Angeles.

For speeding precision production

AUTOMATE

with

Erickson Indexers

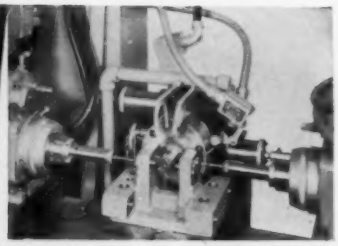


model 400 indexer

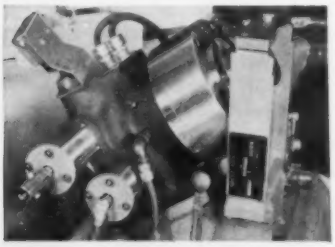
Perhaps these actual applications of automation will trigger your imagination . . . show you how Erickson Indexers can help you smash bottlenecks in your own production operation.

You can interlock them into production setups with microswitches and solenoid valves. And with Erickson Indexers you automatically get consistent positive positioning within 2 minutes of a degree . . . repetitive accuracy in low "tenths" of a thousandth.

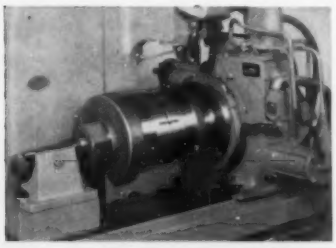
Speed to keep lines humming . . . accuracy to banish rejects . . . long life to slash maintenance and capital investment—all add up to Erickson Indexers. A-1562A



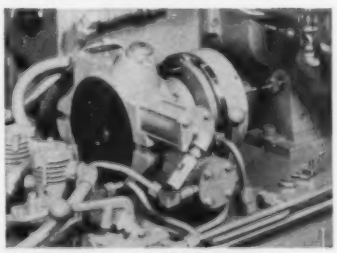
Automatic drilling of cross holes being done on Erickson Model 400 Speed Indexer with air cylinder and Expanding Drawbar Mandrel. Indexer equipped with interlock limit switches.



Angular drilling in jet part held in air operated collet chuck on Erickson indexer operating automatically. Entire fixture designed and built by Erickson.



Using end-clamping for half bearing, machine mills 8 oil grooves then skip indexes back to starting position for next part.



Milling four and six flats on needle valve part. Owing to size, part is placed in tail stock head-first, and tail stock then positions it in chuck and retracts.

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COLLET CHUCKS • EXPANDING MANDRELS • AIR-OPERATED CHUCKS • FLOATING HOLDERS • TAP CHUCKS
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• EXPANDING COLLETS • END-CLAMPING CHUCKS • AIR CYLINDERS (allowing stock to pass through)
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Field Notes

Alex Currall, assistant secretary at the British Board of Trade, will head the newly formed **Industrial Development Office** which the British Government is setting up in New York. Purpose of the Board is to assist prospective American investors in Britain. It will incorporate the representatives of the regional development associations already here to promote capital investment in various parts of the British Isles. Their joint task will be to inform American manufacturers of the opportunities for setting up enterprises in the United Kingdom and of government assistance available. Currall will be joined later by two members of the Northern Ireland Ministry of Commerce.

The Schools of Civil and Mechanical Engineering at the University of Pennsylvania, which have long been separate units, will be combined to form the **Towne School of Civil and Mechanical Engineering.** According to President Gaylord P. Harnwell, the action is being taken in recognition of the fact that a number of subjects, including structures, mechanics and fluid flows, are of common interest to students in both schools.

In addition, the merger will offer greater opportunity for the further development of instructional and research programs in engineering mechanics, aeronautics and other studies related to space.

The graduate program in engineering mechanics, now an interdepartmental program, will center in the new school, where the master of science degree in that field will be awarded. Students majoring in mechanical engineering and those majoring in civil engineering will continue to receive the degrees of bachelor and master of science in their respective fields.

expansions

Bendix Aviation Corp. has acquired an 80-acre tract in the San Fernando Valley for the site of its new electronics center. The first building of the 650,000-sq ft facility will be ready for occupancy early in 1961.

Continental Copper & Steel Industries, Inc., will extend its manufacturing operations with installation of a copper rod rolling mill for its Hatfield Wire & Cable Div. The new facility at Linden, N.J., being installed under contract with the Loewy-Hydropress Div. of Baldwin-Lima-Hamilton Corp., will reduce wire bar to wire rod for subsequent drawing to various sizes in already existing Hatfield facilities.

Metal Forming Corp., a division of Vanadium-Alloys Steel Co., has completed a major expansion program at Elkhart, Ind. The new wing, constructed of cement block and steel, adds 24,000 sq ft of floor space to the facility. Metal Forming Corp. rolls strip metal into intricate moldings used for trim and structural parts.

Adamas Carbide Corp., Kenilworth, N. J., has started construction of an addition to its present building. The addition will be devoted to production of tungsten carbide tools, tool tips, dies, wear parts, toolholders and powders.

Approximately $4,000,000 will be invested in new construction and equipment modernization of Refractories Division plants of **H. K. Porter Co., Inc.,** at Bessemer, Ala., and Wellsville, Ohio. The modernization and expansion steps, geared to meet modern steelmaking practices, are expected to increase brick production, provide new products and improve quality control.

Keystone Mfg. Co. of Warren, Mich., has completed the expansion of its Special Products Div., which will offer design, engineering and fabrication service for all types of custom wiring enclosures. To produce the enclosures, the firm has increased machine tool facilities and has added an extensive stock of special tooling.

Expansion of **Mech-Tron Instrument Corp.,** Wethersfield, Conn., a wholly owned division of Arrow Tool Co., has been announced by David Dewhurst, Mech-Tron president. The services that Mech-Tron is now offering cover engineering from tool design through the product designing, development and production phases of mechanical, electromechanical and electronic equipment.

Moving to meet a rising demand for enamel-coated aluminum sheet, **Aluminum Company of America** has announced plans to double its capacity for manufacture of that product. Alcoa disclosed that it will begin immediately to construct two new "paint lines" within existing buildings of its Davenport, Iowa, sheet and plate mill. Both units are scheduled for completion during the latter part of 1960.

new facilities

Plans to construct the first commercial liquid air separation plant in the state of Florida have been announced by **Air Reduction Sales Co.** The multimillion dollar installation will have a production capacity of 25 tons of high purity liquid oxygen per day as well as liquid nitrogen and liquid argon. Ground-breaking for the new plant will take place in March, with completion scheduled for the summer of 1960.

Saxton Nuclear Experimental Corp. has begun construction of a nuclear reactor near Saxton, Pa. Primary purpose of the project is to find ways in which more useful heat can be obtained from burning nuclear fuel. It is not anticipated that the reactor will be an economic producer of electric power since it is being built for research and development.

A new research and quality control laboratory has been opened in Latrobe, Pa., by the spring and forge division of **Alco Products, Inc.** The laboratory will pursue research in steel-making technology and will aid in maintaining quality control of steel forgings produced at the firm's Latrobe plant.

Norge Div., Borg-Warner Corp., has selected Fort Smith, Ark., as the site of its new 1,000,000-sq ft plant. The plant will accommodate 1500 to 2000 employees and will be used to manufacture gas appliances.

acquisitions

H. K. Porter & Cie S. A., international subsidiary of H. K. Porter Co., Inc., Pittsburgh, has acquired 51 percent of the stock of King Aircraft Corp., Ltd., Glasgow, Scotland. Acquisition of this interest in King Aircraft is the second European investment of Porter & Cie, a friction material plant in Holland having been acquired in December.

Acquisition of an interest in International Ultrasonics, Inc., Rahway, N.J.,

1st Showing

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ALL NEW, FULLY AUTOMATIC
BAR AND CHUCKING MACHINE

★ Production Increase . . . of 50% to 300% per machine, can be made.
★ Reduce Labor Costs . . . one man can operate two or more machines, fatigue factor minimized.
★ Fast Set-up . . . makes jobs of only 5 to 20 pieces as profitable as long runs.
★ Dual Purpose . . . handles both bar and chucking work.
★ Automatic Selection . . . of speeds and feeds.
★ Greatest Dollar Return . . . on lowest capital investment.

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McCROSKY
Series "900"
MILLING CUTTERS

Face, End and Half Side Mills Fitted with Square or Triangular "Throw-Away" Carbide Inserts

● Unsurpassed dependability and economy. Inserts are positioned accurately on ground surfaces in the body, locked rigidly and held solidly even under heavy work loads. Can be released easily and indexed quickly on the machine, assuring almost uninterrupted production. 24 standard sizes, 4" to 12" in dia. Also "Specials" to meet any requirement.

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COST CUTTING TOOLS
Engineering and Sales Representatives in the Principal Cities

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Field Notes

by Aero Supply Mfg. Co., Inc., Corry, Pa., has been announced by Thomas J. Scarpa, president of **International Ultrasonics.** The agreement includes options for Aero to acquire up to 50 percent of International Ultrasonics.

Ex-Cell-O Corp., Detroit, has announced acquisition of all the outstanding capital stock of Optical Gaging Products, Inc., Rochester, N. Y. Optical Gaging Products is a manufacturer of standard and custom chart-gages and staging fixtures for optical projectors as well as layout machines and materials.

Lockheed Aircraft Corp. has announced an agreement to acquire Colby Steel and Mfg., Inc., Seattle, and Colby Crane and Mfg., Ltd., of Vancouver, B. C. Lockheed has also reached an agreement to acquire 50 percent of the stock of Grand Central Rocket Co. of Redlands, Calif.

Boards of Directors of **Gorham Mfg. Co.** of Rhode Island, and Pickard & Burns, Inc., of Needham, Mass., have approved terms of the acquisition by Gorham of all the assets of Pickard & Burns. Pickard & Burns is prominent in electronic navigation, communications, radar systems and instrumentation.

new companies

Joseph V. Emmons, who retired Dec. 31 as metallurgical and research consultant at Cleveland Twist Drill Co., has opened an office at 3284 Chadbourne Rd., Cleveland. Emmons intends to continue in engineering work as a consultant in the fields of physical metallurgy and metallurgical research as well as in the field of patent engineering. He will continue with Cleveland Twist Drill as a member of the Board of Directors.

A new sales company, **Gaskill, Nystrom & Company, Inc.,** has been formed by David M. Gaskill and William T. Nystrom. With headquarters at 761 Park Ave., Cranston, R. I., and resident sales engineers in Boston, Hartford and Albany, the company will specialize in the specification and procurement of precision gaging and measuring equipment.

Formation of a new company, **Boride Products, Inc.,** has been announced by James W. Frederick and Charles G. Henning of Detroit. Offices and plant are at 830 E. Drayton Ave., Ferndale, Mich. The company will handle U. S. distribution of gages and other indus-

trial tools made of boron carbide produced by a French patented process.

awards

Herbert P. Sedwick has received the 1960 Washington Award of the **Western Society of Engineers** at a special presentation dinner. Sedwick was honored "for leadership and achievement in electric and gas utilities, for true service in educational and humanitarian fields, and for developing young engineers."

Two plants of The National Supply Co. will share the "Big Iron Man" Award in recognition of perfect safety records in 1959. The award is made annually by **Armco Steel Corp.** for the best safety record in its larger subsidiary plants.

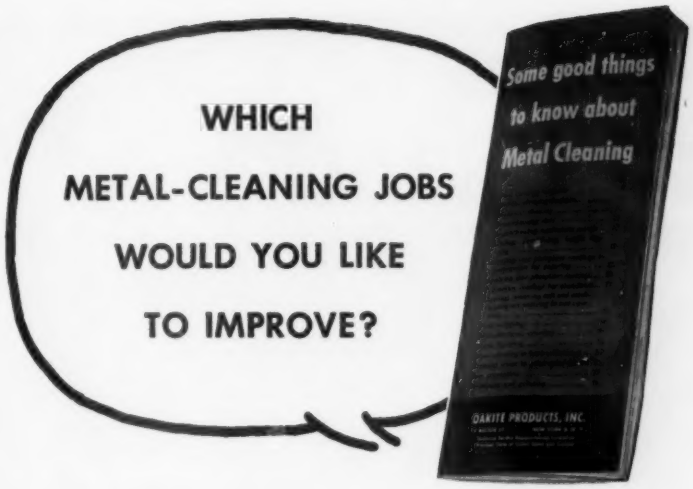
Three engineers of Westinghouse Electric Corp. were awarded first prizes for their technical papers at the **American Institute of Electrical Engineers** winter meeting in New York. The winners are: V. S. Thomander, R. C. MacIndoe and N. F. Schuh. Coauthoring Mr. Schuh's paper, and also a first-prize winner, was R. J. Tallent of Boeing Airplane Co.

Awards Committee of the **American Society of Lubrication Engineers** has announced that John Boyd, manager, Bearing and Lubrication Section of Westinghouse Research Laboratories, will receive the 1960 ASLE National Award. Boyd is currently serving as editor of *Lubrication Engineering*, the Society's monthly journal.

association news

The Metal Powder Industrial Federation has announced the election of the British Metal Sintering Association and the Japan Powder Metallurgy Parts Manufacturers Association as "Overseas Cooperating Associations," thus officially linking these organizations in an international program of cooperation in powder metallurgy. Inclusion of the overseas associations in the Federation opens the way to closer cooperation in standardization activities.

Three new ASM Metal Awards have been established by the trustees of the **American Society for Metals**, according to announcement by ASM Managing Director Allan Ray Putnam. Two of the new awards will be given in honor of the late William Hunt Eisenman, a founder member of the Society. The



¶ Are you cleaning metal in the most economical way? *See page 9 of Oakite's FREE booklet on Metal Cleaning.*

¶ Are you cleaning metal the fastest way? *See page 12.*

¶ Do you need room-temperature cleaning combined in one operation with temporary rustproofing? *See pages 12 and 14.*

¶ Do you know the advantages of alkaline pickling? *See page 21.*

¶ Have you compared the values of iron phosphate coating and zinc phosphate coating in preparation for painting? *See pages 22 and 25.*

¶ Can you use a cleaner that removes rust and oil at the same time; often eliminating all need for pickling? *See page 30.*

¶ Do you have trouble stripping epoxy resins, pigment residues, phosphate coatings and under-paint rust? *See page 31.*

¶ How do you clean parts that are too large to be soaked in tanks or sprayed in machines? *See page 31.*

¶ Are you getting full profit out of your finishing barrels? *See page 32.*

¶ What do you do when oversprayed paint neither floats nor sinks in your paint spray booth wash water? *See page 35.*

¶ Do you need better protection against rusting in process or in storage? *See page 37.*

FREE For your copy of *"Some good things to know about Metal Cleaning"* write to Oakite Products, Inc., 34E Rector Street, New York 6, N. Y.

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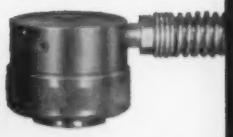

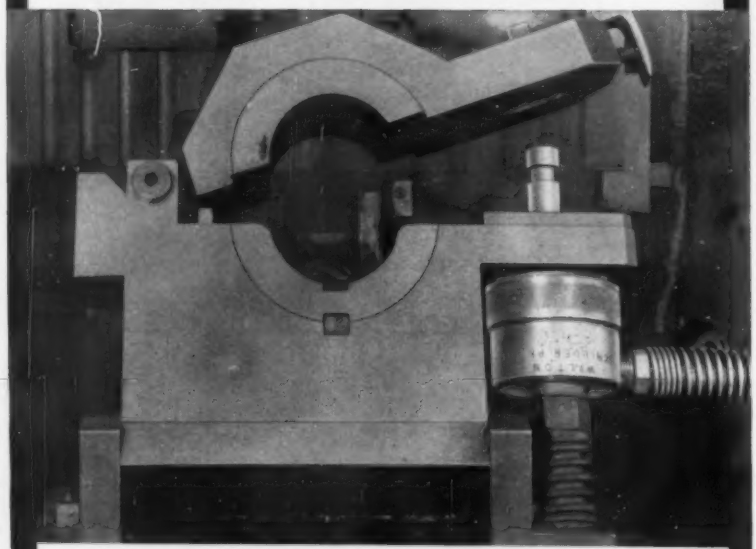

WILTON'S NEW HYDRAULIC FIXTURE LOCKING SYSTEM

*that boosted output here 51%!**

Operation: Broaching	Here one PowRlock head is used on a hinged fixture that holds a cylindrical work piece inclined at 30°, to minimize the impact during broaching. Fixture top swings up 90° eliminating interference during loading and unloading operation.
Work piece: Cylindrical casting	
Loading work piece:	Work piece loaded in, fixture top dropped down.
PowRlock operation:	Spring loaded retaining collar engages groove in PowRlock stud. PowRlock activated by hand lever exerts a 5000 lb. pull on stud, locking work piece in fixture during broaching.
Unloading work piece:	Fixture top raised, work piece removed.
Production record:	With PowRlock—124 pcs. per hour; manual tightening—82 pcs. per hour. *plant name on request.

PowRlock never becomes obsolete—adapts to all work holding fixtures!

Air-Hydraulic Booster cylinder provides hydraulic pressure

one to eight PowRlock heads can be operated from one booster system.

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Field Notes

third is in the name of the late Dr. Marcus A. Grossman, a past president of ASM.

Gray Iron Founders Society, Inc., and **Designers for Industry, Inc.,** have announced a cooperative iron casting design service to serve industries throughout the United States and Canada. The Founders Society is the national trade association of gray iron foundries. Designers for Industry, Inc., is an independent engineering research and development firm.

new activities

Lake Erie Machinery Corp. of Buffalo, N. Y., has reopened its Detroit District office and has appointed Theodore L. Theodorff as district manager. This office, located in the Robinson Building, 18450 Livernois Ave., Detroit, will serve the eastern half of Michigan as well as the western part of Ohio, including Cleveland, Cincinnati and Toledo.

Stockholders of **Bendix Aviation Corp.** have voted to change the company name to "The Bendix Corp." Plans call for the name change to go into effect June 1.

Stone Machinery Co. of Manlius, N. Y., has announced the appointment of Mercator Corp., 607 Washington St., Reading, Pa., as its export agent. Mercator will handle sales of Stone's complete line of metal cutoff machines in all countries except Japan, where existing distribution will be maintained.

L. S. Starrett Co. has opened a new Los Angeles branch office and warehouse at 5946 E. Washington Blvd., Los Angeles. The new integrated office and warehouse building is similar to the branches opened recently at 4949 W. Harrison St., Chicago, and at 48 Commerce St., Springfield, N. J.

General Electric has established a component sales office with headquarters in Fort Wayne, Ind. Arthur W. Bartling, formerly manager of Specialty Sales in the company's Apparatus Sales Div., Schenectady, has been named manager of the operation.

Johnson & Hoffman Mfg. Corp., Mineola, N. Y., manufacturers of precision metal stampings and deep-drawn parts, has appointed Yarbrough Sales Co., 2636 Mission St., San. Marino, Calif., as its sales representative for California, Washington and Oregon.

technical shorts

Improved Aluminum-Magnesium Alloys

Aluminum Company of America has announced development of a new tempering process which increases strength and reliability of the strongest of the aluminum-magnesium alloys. Making use of two new tempers, designated —H323 and —H343, the process assures maximum resistance to stress corrosion for sheet in alloys 5456 and 5083.

Previously, high strength and reliability were obtained in 5083 sheet by cold working the metal to the —H32 and —H34 tempers, a process which increased the metals susceptibility to stress corrosion. The new tempering process now provides maximum resistance to corrosion without sacrificing any of the properties obtained by cold working.

Plastic Conduits Replace Ceramics

Plastic tubing is replacing conventional wood and ceramic conduits in many electrical applications. Because of its flexibility plastic conduit permits bends that are difficult to make with wood and impossible to make with ceramics. In addition, the strength of plastic tubing is such that it allows replacement of two-inch diameter ceramic conduit with one-inch plastic conduit.

One company uses the conduit for runs from distribution transformers under cross arms and along poles to 120-v feeder lines. It is also used for wire components in the 120-v circuits of street-lighting assemblies.

Clad Tube Sheet Sizes Increased

Equipment installed by Bridgeport Brass Co. has enabled the company to increase diameters of clad tube sheet from 26 to 42 inches. Bridgeport's cladding process makes it possible to combine two metals, taking advantage of corrosion resistance of one and lower cost of another. Estimates of savings range from 15 to 45 percent of costs for solid tube sheet when the higher priced for metal must be used because of its specified physical and chemical properties.

A patented process is used by Bridgeport to bond metallurgically most brazeable metals. Thicknesses up to four inches can be achieved with cladding varying from 1/64 to 1/2 inch.

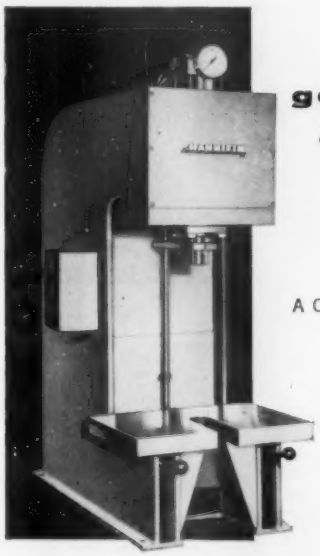
Because of their low cost and their properties of corrosion resistance, clad metal tubes are being used increasingly in heat exchanger applications. Although clad metal tube sheets combine ideally with Duplex tubes, their use is not limited to such installations. In practice they are more often used in conjunction with single metal tubes.

Cobalt Improves Stainless Steel

Research conducted at the Centre National de Recherches Metallurgiques in Leige, Belgium, has shown that Cobalt additions to chromium stainless steels has a favorable effect on the Steels' corrosion resistance. Stainless steels investigated contained 17 and 27 percent chromium and nickel contents of 0.2, and 9½ percent. Cobalt additions ranged from 1.5 to 10 percent.

Tests confirmed that cobalt increases corrosion resistance in acid solutions. After appropriate heat treatments, the cobalt-alloyed steels showed diminished susceptibility to intergranular corrosion.

Reprints of the research report are available from the Battelle Memorial Institute, Columbus, Ohio.



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- Preforming—Compacting

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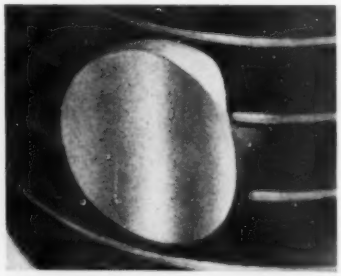

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- Cut downtime—won't budge even in the face of severe impact, shock, vibration.
- Cut damage to machinery, which results when screws come loose.

UNBRAKO socket screws with Nylok are easily removable, repeatedly reusable (pellet seeks to regain original shape when removed). For complete information, see your authorized industrial distributor or write SPS—manufacturer of precision threaded fasteners and allied products in many metals.

*T.M. Reg. U.S. Pat. Off., The Nylok Corp.

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Richard C. Diehl, left, has joined Koppers Co., Inc., as a vice president in the engineering and construction division. He had been vice president-operations of Universal Cyclops Steel Corp. Prior to joining Universal Cyclops in 1957, Diehl was, for seven years, president of the Chase Brass & Copper Co. He will serve as advisor to Acerias Paz del Rio, a steel firm in Bogota, Columbia, S. A.

Roger Marriott, right, has been elected president and general manager of the Barnes Drill Co., Rockford, Ill. He succeeds A. M. Johnson, a member of the Rockford chapter of the ASTME, who recently announced his retirement from the presidency, but continues to serve as a director and consulting engineer for Barnes. Harold A. Johnson has been named executive vice president.

Men at Work

Harry L. Wardrip has been appointed vice president in charge of sales for the Dumore Co., Racine, Wis. He joined the company in 1943, became assistant sales manager in 1946, and served as export manager until his appointment as sales manager in 1958. Wardrip succeeds Tom Carroll, who was recently named executive vice president of the Master Mfg. Co., a Dumore subsidiary.

David R. Falvey has been appointed testing machine engineer for the Hunter Spring Co., a division of American Machine & Metals, Inc., Lansdale, Pa. A mechanical engineering graduate of Yale University, Falvey has served with the Allison Co., The Budd Co., and Remington Rand Univac where he handled a variety of design and development projects. His work at Hunter will be in inspection equipment.

James S. Locke, newly elected corporate vice president of the Minneapolis-Honeywell Regulator Co., has been named vice president and general manager of the company's Brown Instruments Div. Locke, who had been vice president and general manager of Honeywell's Micro Switch Div. since 1958, also will be responsible for the Valve Div., Fort Washington, Pa. and the Fall River, Mass., Div.

Gunnar E. Gunderson, formerly president of the firm, has been elected chairman of the board and chief executive officer of Brad Foote Gear Works, Inc., both newly created posts. Succeeding him as president is Harold J. Buescher. Gunderson is a co-founder of Brad Foote. He formed the corporation in 1925, began as vice president and was elected president in 1950.

JAMES W. HATCH has been appointed general manager of the Downey, Calif., plant of Ex-Cell-O. He joined the tool engineering department of the company at Detroit in 1937.

The Baird Machine Co., Stratford, Conn., has appointed FRANK C. HOLMES vice president for sales, BURTON F. LEWIS to the post of vice president for engineering, and C. P. FOREMAN as chief tool engineer.

Appointments to two newly created positions have been announced by Stewart-Warner Corp. WALTER SCHMID, with the company since 1930, most recently as chief process engineer, has been named manager of manufacturing-engineering. JOHN SIMKUS, with Stewart-Warner since 1942, has become superintendent of all Allemite and Instrument assembly operations and departments.

Hartford Machine Screw Co. has promoted J. F. MILLER to the position of vice president-sales and M. J. PERRIN from factory manager to vice president-manufacturing.

Announcement has been made of the appointment of BYRON MUMAW as superintendent of machine and erection shops for the Rolling Mill Div., E. W. Bliss Co., Salem, Ohio. He has been with the company since 1936.

Men at Work

THOMAS A. TISCHLER has been appointed plant manager in charge of manufacturing at the Mercury Tool & Die Co., Inc., Ferndale, Mich.

FRED B. O'MARA has been named director of manufacturing for National Carbon Co., a division of Union Carbide Corp., succeeding H. T. REID. He will be located at the company's production headquarters in Cleveland.

Appointment of GEORGE E. GUNDERSON to the newly created post of vice president in charge of production has been announced by Brad Foote Gear Works. He joined the company in 1943 as a machinist, held several factory positions, was promoted to process engineer and, since 1957, was assistant production manager.

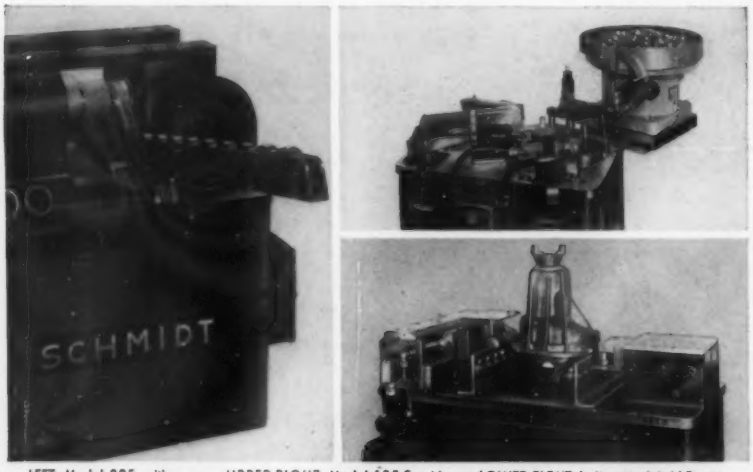
JOHN F. CAIN has been named president of Greer Hydraulics, Inc. The company will soon move its executive offices and plant from New York to Los Angeles, Calif.

George F. Topinka has been appointed chief engineer for the Power Cylinder Div., Hannifin Co., Des Plaines, Ill. He went to Hannifin from the Borg and Beck Div., Borg-Warner Corp. where he was administrative engineer in charge of new product design and development. Topinka received his degree in mechanical engineering at Purdue University and his MBA degree from the University of Chicago.

D. W. BLEND has been elected a director and vice president-operations of Calumet & Hecla, Inc. He was formerly vice president of the company and general manager of the Wolverine Tube Div.

LAD J. BAYER has been appointed general manager of the Control Instrument Div., The Warner & Swasey Co. He has been with the company since 1935, most recently serving as chief industrial engineer.

William Bournias, above, has been named chief engineer of the Buhr Machine Tool Co., Ann Arbor, Mich. He has been with the company since 1956, serving as project engineer on special multiple operation machine tools. In his new position, he will be responsible for all engineering work and engineering personnel.



LEFT: Model 385, with remote hydraulic unit, marks inner and outer surfaces of bearing races at rate of 2000 per hour.

UPPER RIGHT: Model 135-S, with hopper feed and air ejection, is fully automated to mark 1800 to 2400 transistor cans per hour. Marks both top and sides.

LOWER RIGHT: In line Model 465, with serial numbering head, marks date and consecutive serial number on 1200 gear carriers per hour. Equipped with conveyor type fixture.

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Arthur S. Nippes, above, has been appointed a vice president of the Farrel Foundry & Machine Co., Waterbury, Conn., a division of Textron, Inc. He was previously consultant to the president of Simonds Saw & Steel Co. and vice president and general manager of the Disston Div., K. H. Porter Co. Nippes received his degree in mechanical engineering from Pennsylvania State College.

HAROLD ELLEFSON has been appointed superintendent of production, and RUSSELL WILLIAMS named supervisor of maintenance, toolroom and plant protection, at the Maytag Co. Hampton, Ia. plant.

JOHN F. TORLEY has been appointed vice president-manufacturing of the Industrial Div., National Malleable & Steel Castings Co. WILLIAM JOST, JR. replaces Torley as manager of the Chicago Works.

James F. Horgan, above, has been appointed manager of experimental development for the Micromatic Hone Corp., Detroit, Mich. He joined the company in 1947 after receiving his degree in electrical engineering from the University of Michigan, and rose from electrical designer to supervisor of electrical engineering. Horgan's most recent post was as supervisor of engineering development.

OTTO J. MANSE has been named manager of manufacturing at Rollway Bearing Co., Syracuse, N. Y. He was formerly associated with Westinghouse Electric Corp. and, most recently, with the O. M. Edwards Co., Inc.

ORVAL A. OPPERTHAUSER has been appointed to the position of chief engineer at F. Jos. Lamb Co., Detroit, Mich. He will be responsible for coordination and supervision of proposals and quotations, design engineering and machine assembly schedules.

RAY KRAUSE has been appointed vice president in charge of engineering at Lester Castings, Inc. of Bedford, Ohio. He was with Skil Tool & Die Co. and National Malleable & Steel Castings Co. before joining Lester in 1958.

CHARLES M. EDWARDS has been named assistant to A. P. FONTAINE, executive vice president of Bendix Aviation Corp. DR. G. A. ROSSELOT has been appointed assistant general manager and associate director of the Research Laboratories division of the company.

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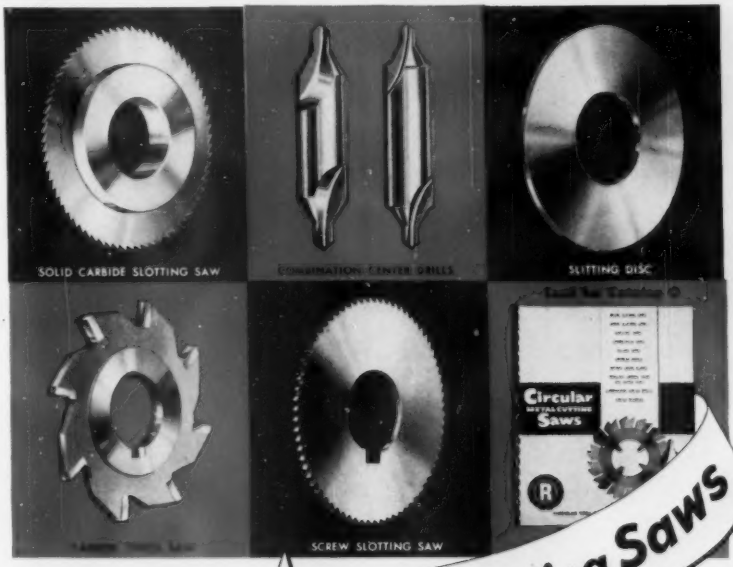

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Men at Work

Gordon L. Schuster, above, was recently appointed president of Timesavers, Inc., Minneapolis, Minn. He succeeds R. F. Pendergast, founder of the company, who will continue as advisor and chairman of the board of directors of Timesavers. Schuster was formerly with the Despatch Oven Co., Minneapolis, which he joined in 1940 and served as both chief engineer and president.

Illinois Tool Works, Chicago, has announced three executive appointments and promotions. ANDREW L. PONTIUS, vice president, was named vice president in charge of operations, Products Div. WILLIAM E. BRUSE succeeds him as general manager of the Shakeproof Div., Elgin, Ill. KENNETH C. MACKAY was named plant manager, succeeding Bruse.

Charles E. Bain, above, has been elected vice president and general works manager of the American Pulley Co., Philadelphia, Pa. He will be responsible for product development, research, engineering and manufacturing. Bain joined the company in 1952 and has held the positions of manager of manufacturing and general works manager. He was formerly with several other manufacturers.

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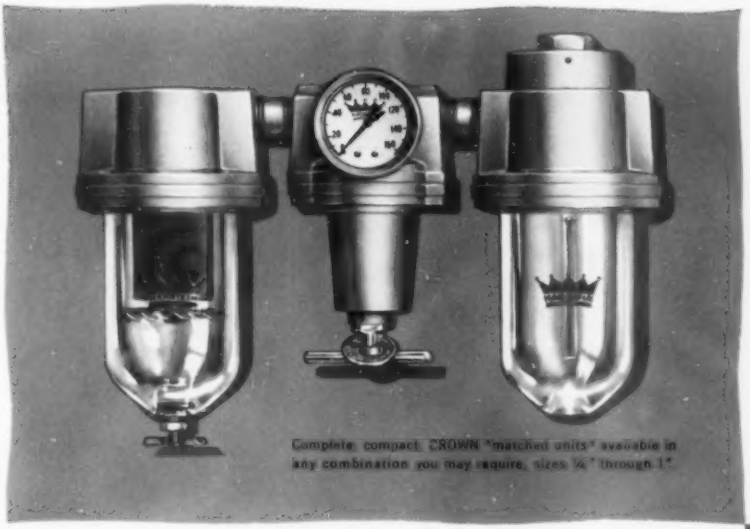
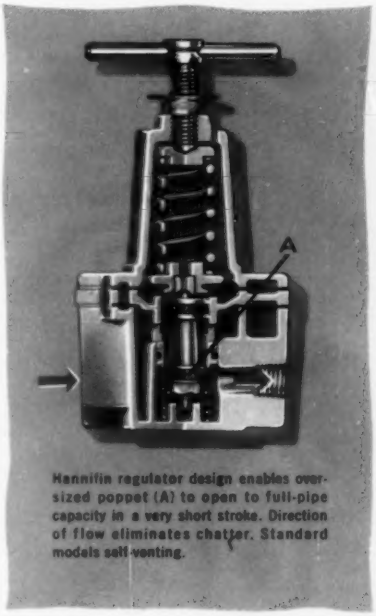


Complete compact CROWN "matched units" available in any combination you may require, sizes ¼" through 1".



Hannifin regulator design enables oversized poppet (A) to open to full-pipe capacity in a very short stroke. Direction of flow eliminates chatter. Standard models self-venting.

Hannifin CROWN "Combo" units – filters, regulators and lubricators in any combination – keep compressed air in the "pink of condition" without depriving you of needed air flow.

Crown regulators open fast on demand, close precisely when demand is satisfied, deliver the exact amount of air needed. Their "piston balanced" poppet design, which makes possible a flat, large-area, poppet-type valve with very short stroke, is the reason. The inherent stability of this design – no hunting or chatter – results in multi-million cycle life.

Crown filters have large, reusable filter elements for minimum resistance to air flow. Crown lubricators introduce predetermined amounts of oil into the air stream, automatically. Their design is so responsive to variations in air flow rate that the concealed, tamperproof adjustment is rarely used. This is the easiest lubricator of all to fill, and remote-fill models are available.

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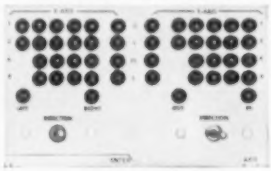

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.....readers' viewpoints

...taper measurement

To the Editor:

We would like to offer our comments on the article "Direct Measurement of Taper" by George Gershman (THE TOOL ENGINEER, Jan. 1960, p. 85).

Mr. Gershman makes mention of the fact that the new taper checking device eliminates the necessity of removing the part from the lathe or grinding machine for measurement of taper. This, of course, takes a crack at precision machines such as the comparator which offers an excellent and extremely accurate method of checking taper.

On page 86, Mr. Gershman speaks of a portable machine, Fig. 3, which requires removal of the part from the machine—a contradiction to his previous statement. He also states that other measuring devices require that the part be removed from the machine and taken to other areas, a time-consuming task.

This is not entirely true because many tapers are checked on optical comparators which are located in the immediate vicinity of equipment performing the machining operation.

Mr. Gershman refers to the accuracy of his equipment — equipment which would not be nearly as accurate for measuring taper as a standard optical comparator for two reasons:

1. His sine bar length of engagement is extremely short when compared to the 30-inch sine bar length possible on a 30-inch comparator.
2. Assuming that this mechanical device can check taper accurately, no provision exists for checking the relationship of the taper to the axis of rotation of the part.

In addition, the many joints inherent in their mechanical device would detract from its ability to measure to the limits of accuracy which are possible with an optical comparator. Because the comparator takes a direct projected reading of the taper onto the comparator screen, all mechanical errors are eliminated.

Unquestionably, this piece of equipment would do very nicely as a replacement for mechanical ring and plug gages, but it certainly should not be compared to an optical comparator.

Harold L. Murch
Manager of Sales
Comparator Div.
Jones & Lamson Machine Co.

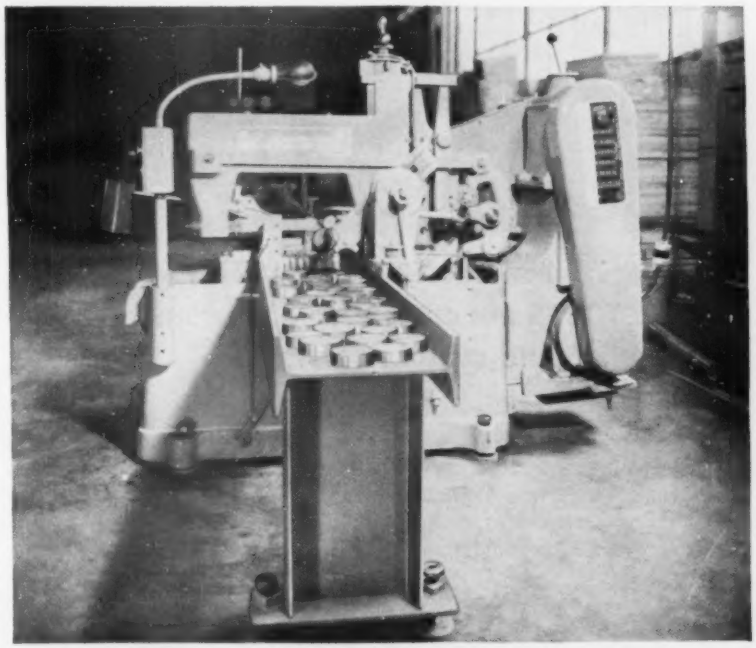
Mr. Murch has generalized one case history into a comparison between taper micrometers and optical comparators. No such comparison was drawn or inferred . . . and the only reference to optical comparators appeared near the end of the article, in connection with the manufacture of tapered reamers.

This case history was cited to show how a taper micrometer was found to be useful when circumstances prevented the use of optical equipment at the machine. The fact that many plants have such equipment in the vicinity of their taper-cutting machines is irrelevant. This case history was used to illustrate a situation that does exist in other plants.

The bench model micrometer shown in Fig. 3 was designed for a customer's inspection department in order to measure reamers when they are removed from the machine. As stated in the text, a similar micrometer can be applied manually to the work while it is still in the machine. Examination of the text will show no contradictions.

The accuracy of the taper micrometer is identical to the accuracy of the micrometer spindle which is ample for most purposes. When greater accuracy is required, more expensive and refined equipment must be incorporated in the taper micrometers.

The one-inch sine bar is made to a tolerance of 0.000010 inch. This dimension is known more accurately than is the spindle movement. With regard to inaccuracies supposedly inherent in this tool because of the many joints . . . the joints cause no inaccuracies because the micrometer is first adjusted to read zero



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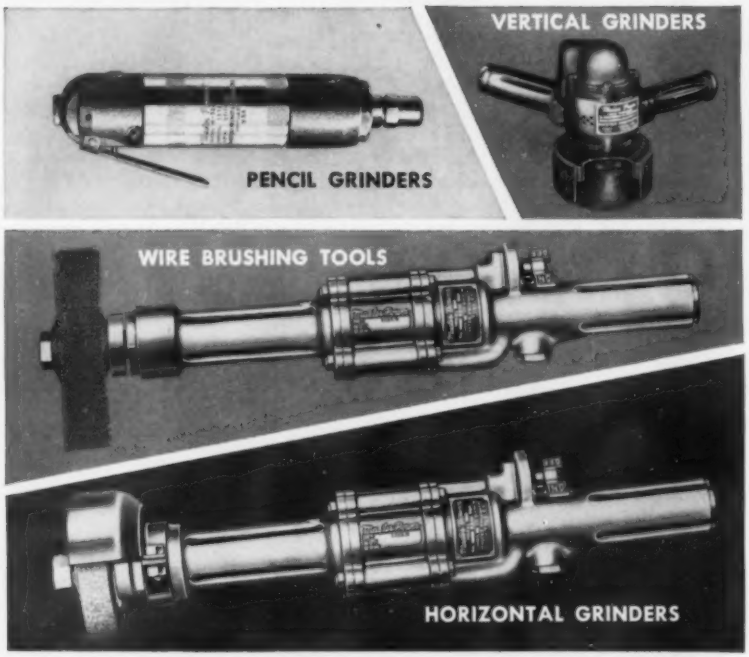

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when the sine bar and anvil bar are parallel.

As for checking the relationship between taper and axis of rotation, this is accomplished by inspecting the part on the centers on which it was produced.

Taper Micrometer Corp.
George L. Gershman

. . . machining cast iron

To the Editor:

I found the article "Machining Cast Iron with Ceramic Tools" which appeared in the February 1960 issue of THE TOOL ENGINEER very informative. However, I would like to call your attention to an apparent error in the equations used.

If we follow the designations of the author, and understand that the net horsepower is the horsepower measured on the cutting edge, the two formulas, listed in the right column of page 119 should read:

$$N = \frac{P_v \cdot V}{33{,}000}$$

and

$$V = \frac{33{,}000 \cdot N}{P_v}$$

Evidently the author committed his mistakes by not converting all of this data from Metric to American system of measures.

These mistakes in no way reduce the value of this interesting article.

Antoni Niedzwiedski
General Electric Co.

This error in transposition was made by THE TOOL ENGINEER and not by the author. Our thanks to Mr. Niedzwiedski for calling it to our attention.

—Ed.

. . . foreign competition

To the Editor:

I read your editorial, "Competition is Universal," with interest.

I noted that you did not touch upon the potential of Japanese industry. Undoubtedly you are aware of the competition we can expect from that area, principally because of Japan's relatively low-wage scale. As an example, on page 125 of the February issue of THE TOOL ENGINEER, Prof. John E. Biegel is shown checking the microhardness of a punched slug with a Sheffield comparator. Having one in our own plant, we note that its nameplate bears the legend, "Made in Japan." We are also forced to conclude that this comparator is one of the best manufactured anywhere.

Perhaps you might wish to include Japan in your next editorial on competition. . . .

Roger W. Wallace
John Oster Mfg. Co.

ENGINEERING BOOKSHELF

MACHINABILITY MANUAL NO. 1—*By John A. Hedrick. Published by Methods Research Co., P. O. Box 143, Parker Ford, Pa. Price $15.*

Designed for computing machining problems on turning, facing, and boring operations, this spiral-bound book will prove handy to many engineers. Computational information is presented in three major sections: the Material Rating List which assigns a machinability key number to the materials usually encountered; and two circular slide rules, a Machinability Selector and a Machining Calculator. The two calculators are printed on plastic material and bound into the book.

A user of this computational aid first selects the key number of the materials to be machined, then by manipulating the Machinability Selector, selects optimum feeds and speeds. The Machining Calculator is used for the final stage of computation, converting fpm into rpm, determining feed and cutting time per piece. Different methods of machining can be rapidly compared and evaluated with this manual.

ENGINEERING ECONOMICS FOR PROFESSIONAL ENGINEERS' EXAMINATIONS—*By Max Kurtz. Published by the McGraw-Hill Book Co., Inc., 330 W. 42nd St., New York 36, N. Y. Price $6.50. 261 pages.*

Designed for use as a college text in engineering economics; for use in preparing for the professional engineers' license; and for use as a reference book, this one compact volume brings together the facts, formulas and tables to help answer most any question likely to arise on engineering economics.

For tool engineers who may move into the financial aspects of management, Kurtz' work will certainly render comprehensible the sometimes confusing concepts of money and investment. Subjects covered include depreciation and depletion, contract law and amortization.

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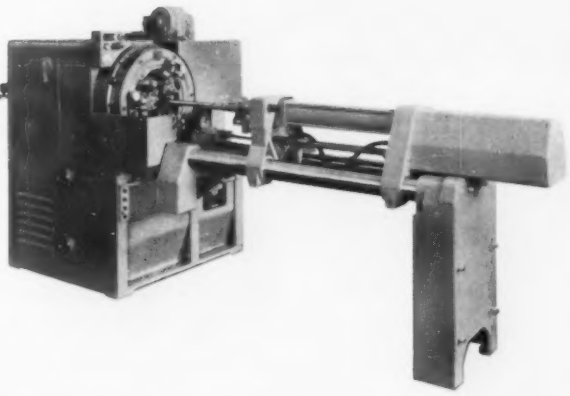

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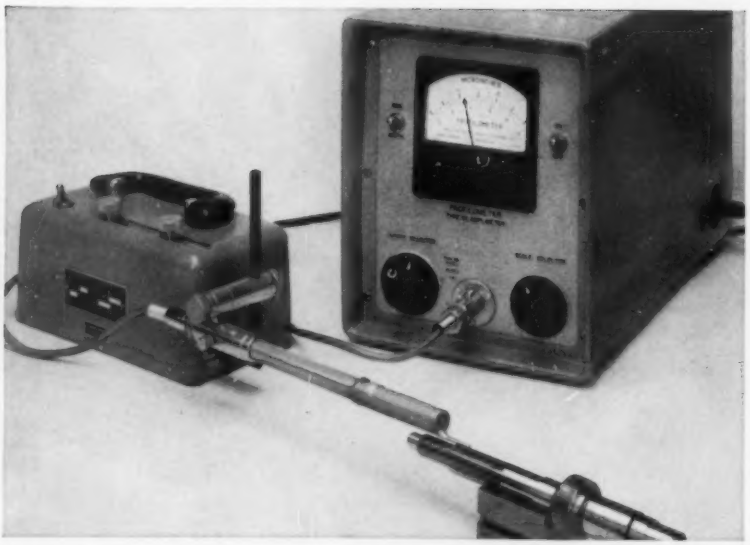

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Engineering Bookshelf

DIMENSIONAL CONTROL IN PRECISION MANUFACTURING—*by John A. Gadzala. Published by McGraw-Hill Book Co., Inc., 330 W. 42nd St., New York 36, N.Y. Price $7.50. 203 pages.*

This book is intended to serve both as a student's text to study the function of process engineering and as a reference guide for the experienced process engineer for dimensional planning. The text proceeds through the necessary steps of developing a complete set of operation process sheets for an exemplary production part. Each step is discussed in detail with special emphasis on dimensional control. The method of constructing a dimensional tolerance chart is described. The author explains the "Method of Traces" for use in calculating accumulations of dimensional tolerances in a sequence of machining operations for the purpose of constructing a reliable tolerance chart.

ZINC—*Edited by C. H. Mathewson. Published by Reinhold Publishing Corp., 430 Park Ave., New York 22, N. Y. Price $19.50. 721 pages.*

Subtitled The Science and Technology of the Metal, its Alloys and Compounds, this definitive monograph results from the work of some forty-five specialists.

The various chapters are written as technical papers and here collected and organized to provide a single source of information on the metallurgy, chemistry, extraction and uses of zinc. Fourteen chapters cover such topics as economics, geology, ore treatment, refining, processing, alloy technology, uses for extraction and zinc compounds.

WELDING OF PLASTICS—*By J. A. Neumann and F. J. Bockhoff. Published by Reinhold Publishing Corp., 430 Park Ave., New York 22, N. Y. Price $7.25. 279 pages.*

For design engineers as well as tool engineers, design procedures and detailed fabrication methods are given in this book. All presently known techniques of welding plastics are described and many are shown in pictures. The most recent welding materials are covered in detail. Chapters include: hot-gas welding, heated tool welding, friction welding, film and thin sheet welding, testing methods and special techniques and applications. Glossary of terms and appendices list names and characteristics of weldable plastic materials.

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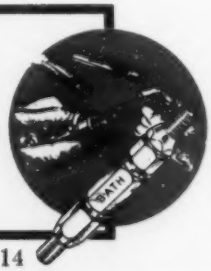

A series of technical discussions that will be helpful in getting better results from tapping and gaging operations

Vol. 1 No. 14

Subject: Class 5 Interference-Fit Thread

This class thread provides by flank engagement, a metal-to-metal fit of an oversize external thread in a standard tapped hole, resulting in plastic flow of metal. So many variables are involved in this type of fit that only until recently has it been possible to set up standards which will satisfy the requirements. Most users have found it necessary to use some version of the principle of "selection" and "fitting" for at least a portion of their products.

Interference-fits have for many years been synonymous with trouble. Based on a recently discovered principle of thread action, the new Class 5 thread dimensions listed in the tables below, together with the other design and application data in ASA-B1. 12 published by The American Society of Mechanical Engineers, offers new hope to users of interference-fit studs, bolts and screws.

External Thread Dimensions for Class 5 Standard*

Size	Major Diameter†						Pitch Diameter † Design Form		Minor Diameter†
	NC5HF for driving in ferrous material with hardness greater than 160 Bhn $L_e = 1¼$ Diam		NC5CSF for driving in brass and ferrous material with hardness equal to or less than 160 Bhn $L_e = 1¼$ Diam		NC5ONF for driving in nonferrous except brass (any hardness) $L_e = 2½$ Diam				
	Max	Min	Max	Min	Max	Min	Max	Min	Max
1/4 - 20	0.2470	0.2408	0.2470	0.2408	0.2470	0.2408	0.2230	0.2204	0.1932
5/16 - 18	0.3080	0.3020	0.3090	0.3030	0.3090	0.3030	0.2829	0.2799	0.2508
3/8 - 16	0.3690	0.3626	0.3710	0.3646	0.3710	0.3646	0.3414	0.3382	0.3053
7/16 - 14	0.4305	0.4233	0.4330	0.4258	0.4330	0.4258	0.3991	0.3955	0.3579
1/2 - 13	0.4920	0.4846	0.4950	0.4876	0.4950	0.4876	0.4584	0.4547	0.4140
9/16 - 12	0.5540	0.5460	0.5580	0.5495	0.5580	0.5495	0.5176	0.5136	0.4695
5/8 - 11	0.6140	0.6056	0.6195	0.6111	0.6195	0.6111	0.5758	0.5716	0.5233
3/4 - 10	0.7360	0.7270	0.7440	0.7350	0.7440	0.7350	0.6955	0.6910	0.6378
7/8 - 9	0.8600	0.8502	0.8685	0.8587	0.8685	0.8587	0.8144	0.8095	0.7503
1 - 8	0.9835	0.9727	0.9935	0.9827	0.9935	0.9827	0.9316	0.9262	0.8594
1 1/8 - 7	1.1070	1.0952	1.1180	1.1062	1.1180	1.1062	1.0465	1.0406	0.9640
1 1/4 - 7	1.232	1.220	1.2430	1.2312	1.2430	1.2312	1.1715	1.1656	1.0890
1 3/8 - 6	1.356	1.341	1.3680	1.3538	1.3680	1.3538	1.2839	1.2768	1.1877
1 1/2 - 6	1.481	1.467	1.4930	1.4788	1.4930	1.4788	1.4089	1.4018	1.3127

*The tables are based on externally threaded members being steel ASTM A-325 (SAE Grade 5) or better. See Table 1.
†All dimensions are in inches. For rolled, cut or ground threads. For definition of thread elements see ASA B1.1, current edition.

Internal Thread Dimensions for Class 5 Standard

Size	NC5IF Ferrous Material			NC5INF Nonferrous Material			Pitch Diameter		Major Diam
	Minor Diam		Tap Drill	Minor Diam		Tap Drill			
	Min	Max		Min	Max		Min	Max	Min
1/4 - 20	0.196	0.206	13/64	0.196	0.206	13/64	0.2175	0.2201	0.2500
5/16 - 18	0.252	0.265	G	0.252	0.265	G	0.2764	0.2794	0.3125
3/8 - 16	0.307	0.321	O	0.307	0.321	O	0.3344	0.3376	0.3750
7/16 - 14	0.374	0.381	3/8	0.360	0.372	U	0.3911	0.3947	0.4375
1/2 - 13	0.431	0.440	11.0mm or 0.4330	0.417	0.429	27/64	0.4500	0.4537	0.5000
9/16 - 12	0.488	0.497	12.5mm	0.472	0.485	31/64	0.5084	0.5124	0.5625
5/8 - 11	0.544	0.554	35/64	0.527	0.540	17/32	0.5660	0.5702	0.6250
3/4 - 10	0.661	0.678	43/64	0.642	0.655	16.5mm	0.6850	0.6895	0.7500
7/8 - 9	0.777	0.789	25/32	0.755	0.770	49/64	0.8018	0.8077	0.8750
1 - 8	0.890	0.904	57/64	0.865	0.880	7/8	0.9188	0.9242	1.0000
1 1/8 - 7	1.000	1.015	1	0.970	0.991	63/64	1.0322	1.0381	1.1250
1 1/4 - 7	1.125	1.140	1 1/8	1.095	1.115	1 7/64	1.1572	1.1631	1.2500
1 3/8 - 6	1.229	1.247	1 15/64	1.195	1.213	1 13/64	1.2667	1.2738	1.3750
1 1/2 - 6	1.354	1.372	1 23/64	1.320	1.338	1 21/64	1.3917	1.3988	1.5000

All dimensions are in inches, unless otherwise specified. For definition of thread elements see ASA B1.1, current edition.

"Extracted from Trial American Standard Class 5 Interference-Fit Thread (ASA B1.12), with the permission of the publisher, The American Society of Mechanical Engineers, 29 West 39th St., New York 18, N.Y."

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Tech Digests

Numerical Control for Design

Visualize a design machine consisting of three elements: a large digital computer, a machine tool and a visual display device. A designer would sit at the console of this unit and display in two or three dimensional form a part or object that is the initial idea. The designer may start with an approximate size and through manipulation of the display from probably three separate views, simultaneously displayed, refine the appearance and dimensions. The digital computer would provide the ability to interpret this display and print out, or indicate, the numerical value representing the shape. Further refinement or modification could continue under the constant surveillance of the designer. When the displayed part and computed dimensions are satisfactory, the designer would so indicate and cause the computer to develop a control tape for directing the machine tool in producing the part. Through the use of stored data on material specifications, cutting loads, speeds, feeds and other related data in metal removing, the computer could select the proper tools and cutting rates to generate the part.

Experience on digital computers makes such a program within the realm of possibility, and as data is gathered from numerically controlled machine tools, optimum values for speeds, feeds, and tools can be computed. This is the possibility of a communication system of the most advanced order, where the translation and interpretation of the numerical data would no longer be limited to manual speeds or the possible errors caused by mental fatigue. The reduced requirement for repetitive detail work from the engineer could result in still more creative thinking.

Based on SAE Paper No. 129A, "Numerical Control in Body Engineering—Fact and Fantasy," by J. C. Gorham and J. R. Ballinger, Bendix Corp. Society of Automotive Engineers, 485 Lexington Ave., New York 17, N. Y.

▼ ▼ ▼

How Common is Common Sense?

Common sense, though fraught with pitfalls, can still be a valuable tool when it is bulwarked with sound statistical inference. The easiest approach to the notion of a statistical model is through population models and includes three avenues: (1) A tabular sample of experimental values from which an average or mean can be approximated. (2) A graphical representation wherein the proportion of data found in any interval is equal to the area of the rectangle above the interval. (3) A mathematical model. The applications of statistical models are necessary in the real world because so often an engineer is dealing with only fractions of a population, or only has time for a few tests which can be costly or destructive. He will then find very valuable such tools as the test of hypothesis, or such applications as the difference of two sample means or tests of reliability. In the field of human engineering, it is more than critical to design one's experiments with sound scientific method as the subject, man, is such an uncontrolled variable. Sound statistics will help to buttress intuition and common sense, so that initial assumption can be made within the rigors of good engineering practice.

Based on ASME Paper 59-A-258 by Paul Lloyd Flatow, N.Y.U. and Gene M. Weeks, Weeks and Associates. Society of Mechanical Engineers, 29 W. 39th St., New York 18, N. Y.

▼ ▼ ▼

Quality Control with Audit Systems

Control through quality audit systems has a wide range of application and is being used quite extensively by some large companies. Using detailed checkoff sheets, a quality audit group will select a random sample of the product and proceed to make a very detailed check of the quality, recording their findings on the check sheets. These records are kept from audit to audit and used in plotting control levels and operating characteristic curves. Those using this system, particularly where they are confronted with a multiplicity of problems on a complex assembly, have found the quality audit system to be the best management tool for assigning priorities and directing action.

Control records on all the above controls are carefully recorded, these records being used for reference on subsequent runs and for information as required by other departments such as sales, engineering, manufacturing, purchasing, etc. The records are also the basis for keeping management informed as to the quality standards of the product; statistics being compiled on acceptances, charges, costs, and scrap.

Based on a paper entitled "Quality Control Applications in Stampings, Welding and the Job Shop," presented by J. Mehalek, The Budd Co. presented at the 13th Annual Convention of American Society for Quality Control, Room 6197 Plankinton Bldg., 161 West Wisconsin Ave., Milwaukee 3, Wis.

▼ ▼ ▼

Machinery Maintenance

The procurement of machinery, being a capital investment, is only justified whenever maximum hours of usage will be obtained—the more machine hours, the better the justification. Every hour of idleness or out of service for maintenance is chargeable against the maintenance department. To be effective, a preventive maintenance program, designed to insure maximum machine operating time and minimize unscheduled downtime, must be instituted.

Such a program will consist of periodic inspection (both visual and tolerance checks), schedules lubrication and a follow-up work order system which enables the maintenance organization to perform, on a scheduled basis, the necessary preventive maintenance work as noted by the inspectors. It has been determined that one inspector (combination mechanical and electrical) can be responsible for 300 average production machines a year. This includes 60 semiannual visual inspections and 25 tolerance checks per month.

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measures the exact BORE or blind hole size!
Reading: .0001"
Size: 3/16" to 4"
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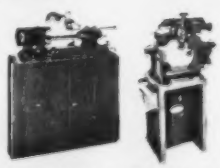

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tech digests

A significant portion of the over-all preventive maintenance program is the scheduled maintenance work order. This work order is performed by the maintenance shop and covers the disassembly of the sliding members, tables, saddles, etc., for the purpose of cleaning, flaking worn ways, assembly and adjusting of gibs, lead screws, clutches, pumps and packing glands, and adjusting belts.

The schedule differs as follows: three-month periods for tool and cutter grinders, six-month periods for engine lathes and turret lathes, and twelve-month periods for large vertical boring mills, milling machines, and large 32-inch engine lathes.

The inspection schedules are given to the manufacturing departments a week in advance and they in turn cooperate by making the machines available for inspection as scheduled. This type of preventive maintenance program has been found to lengthen the period between rebuilds so that under preventive maintenance only two rebuilds are necessary on the average against three under breakdown maintenance during the operating life of the machine.

To obtain comparison figures for unscheduled machine downtime under preventive maintenance programs as against those for breakdown maintenance, records were kept on two groups of machine tools: (1) a group where a preventive maintenance program had been installed, and (2) a group of similar tools—some of which because of distance had not been brought under the preventive program at that time—as well as certain critical machines which production departments could not release because of vital work schedules.

TO REQUEST COMPLETE PAPERS WRITE TO THE ADDRESS AND ORGANIZATION INDICATED AT THE END OF EACH ABSTRACT

After many months of service, the Group 2 machines were beyond the acceptable production tolerances and required major overhaul or rebuild. The cost of the major overhaul by outplant rebuilders in many instances approached or exceeded one-half of the original procurement value. During the Group 2 operating life, only such maintenance as could be done to keep the machines in tolerance was performed. The average scheduled downtime for those under the preventive maintenance program per machine was 150.4 hours

as compared with the unscheduled downtime of 178 hours for Group 2, which received only lubrication. The difference, then, was 27.6 hours per year per machine.

Although the machines in Group 1 operated only 20 percent longer than those in Group 2, some important information became a matter of record:

1. The capabilities of the machine had been established
2. Any operating weaknesses were recorded
3. The machine could be loaded within its capacity
4. The machine rebuild could be forecast and planned
5. The shop is kept currently informed as to the condition of the machine
6. The shop will operate the machine with confidence and care.

Since nearly 600 machines are now under the preventive maintenance program, it is assumed by projection that a savings of 16,560 hours would have resulted had all 600 machines been under the preventive maintenance program during the same period.

Based on an address by Harry Monroe, Rocketdyne Div., North American Aviation, Inc., entitled "Getting at the True Maintenance Costs for Purposes of Comparison" delivered at the 11th Plant Maintenance and Engineering Conference. Copies of the complete talk are available from Banner and Greif, 360 Lexington Ave., New York 17, N. Y.

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Training Maintenance Apprentices and Supervisors

The fundamentals of a sound apprentice program might be best expressed in terms of six basic points. All are needed in order to have a successful program.

The six basic points are:

1. Determine the objectives
2. Make the program flexible
3. Development of the training program
4. Selection of apprentices
5. Establishing adequate records
6. Follow-up.

It should be decided at the outset as to whether "Chiefs" or "Indians" are to be trained. In too many cases, companies use apprentice training as a means of filling a vacancy of a technical nature. This is not to say that graduate apprentices should not eventually enter the higher positions. We should do everything in our power to train people to meet the needs of the skilled shortages as they exist in the trades. If the objective is training people for technical jobs, there should be a training program to train for technicians without putting the individual through a formal apprentice training program first. An apprentice training program should be for the purpose of training tradesmen. The tradesman differs from the technician in that he is concerned with the construction, maintenance, and repair of equipment or product, and the technician is concerned with the design, development, and supervision of equipment or production.

The program should be flexible. This may sound as a contradiction to the first of determining specific objectives, but it is important because oftentimes in developing an apprentice program one can become saddled with unrealistic objectives that are very difficult or impossible to attain. Design programs with a certain amount of flexibility so when changes are necessary they can be made. This point has primarily to do with any formal registration with a state or national agency or your local union agreements.

The actual training program probably needs the most effort to be put forth and most people will have to become involved. There are two phases that must be taken into consideration in developing the actual training pro-

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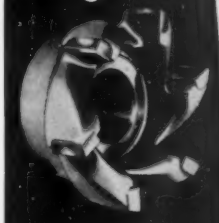

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gram. The first phase is that of the manipulative or performance skills that are to be acquired by the individual, and the second is that of the trade information or related job knowledge that the individual will be required to have. Each phase will require an analysis to be made by someone or some people. The analysis may be made by a training specialist, by a shift supervisor, by a committee of tradesmen, or a combination of the above. The analysis should take three basic steps:

1. A determination of what the individual must be able to do
2. What he should be able to do
3. What would be to his advantage, but not really necessary for him to be able to do.

If an apprentice training program is sound, selection will become a problem more than a need. This becomes a problem because so many qualified people apply for the program that the task of selecting the right employees becomes difficult. Some of the methods that can be used are evaluation of high school records, standardized tests, interviews, or a combination of the above.

TO REQUEST COMPLETE PAPERS WRITE TO THE ADDRESS AND ORGANIZATION INDICATED AT THE END OF EACH ABSTRACT

The fifth and sixth points go together. One serves as a means to the other. A system of adequate records in themselves provides a certain amount of follow-up activity. As the individual performs, he is checked against a master record of the basic analysis. A good apprentice program will provide a system of records to indicate exactly what experiences have been gained by each and every apprentice. It cannot be left to chance that we will assume to remember what the individual has performed. These records should cover such things as job assignments, specific work experiences on those assignments, ratings, how well the individual has performed at various stages in his training program, what classroom work he has accomplished, what grade or scores have been attained, and surely the total number of hours, involved in the basic activities.

Last, but not least, no program can be complete without adequate follow up. Follow-up becomes all the more important as your apprentices are assigned farther away from the headquarters building. A program of follow-up should be provided for the employees

who have completed the training program. By doing this, you will be making a basic evaluation of the training that has been provided. If the individuals trained show a weakness in a certain area, this weakness can be compensated for in future trainees.

Based on an address by John L. Peterson, The Firestone Tire and Rubber Co. of the 11th Plant Maintenance and Engineering Conference. Copies of the complete talk are available from Banner and Greif, 369 Lexington Ave., New York 17, N. Y.

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Elevated Temperature Testing of Flight Vehicle Materials

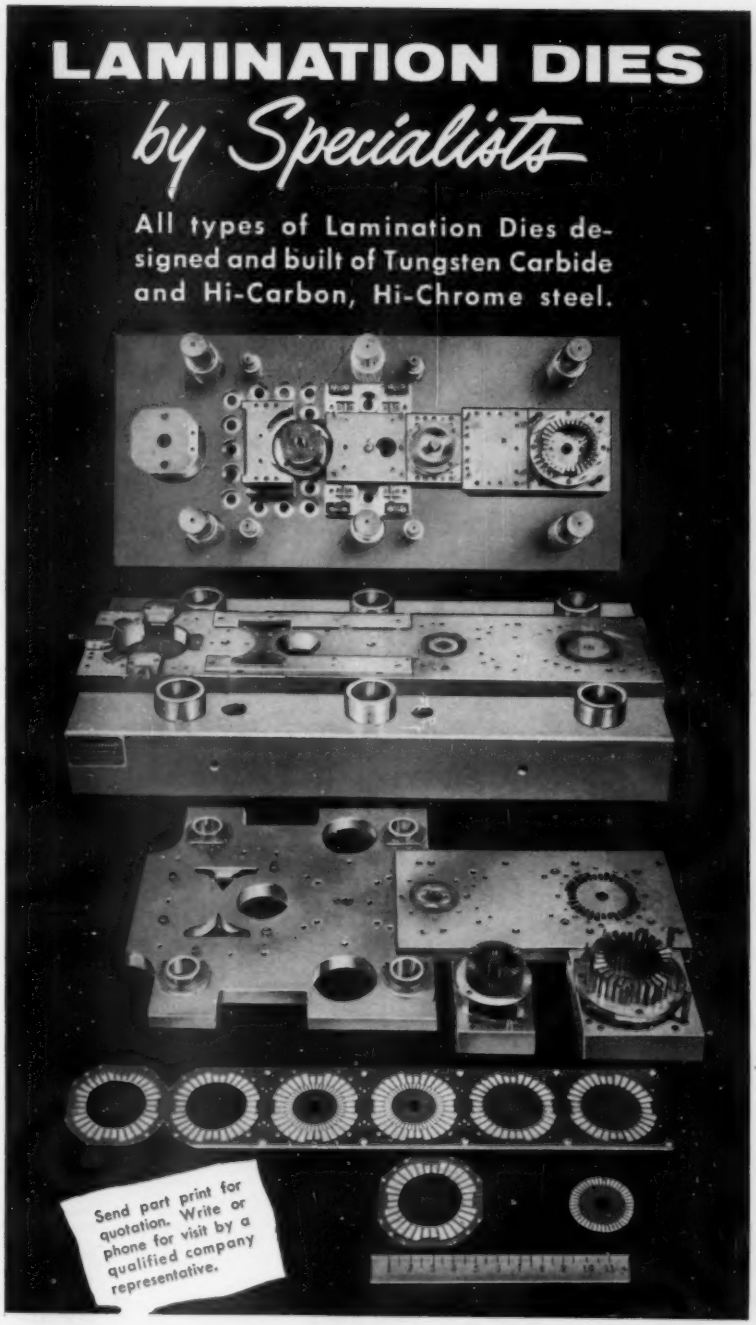
Service temperatures contemplated today are usually in ranges wherein the metallurgical structure of an alloy is unstable to some degree and wherein the creep rates of the material are comparatively high. Under these conditions, the following factors must be carefully taken into account in determining the strength of the material:

1. Loss of strength at the elevated temperature
2. Creep rate of the material during the test
3. Effect of strain rate on the resultant strength level
4. Effect of aging or other metallurgical changes during the test.

In addition to the variations in tensile strength due to the above-mentioned factors, the determination of a design allowable in tension or compression for actual structural design use is critically dependent on the creep behavior of the alloy at the specified temperature.

The use of yield strength and ultimate strength still have an important place in the selection of materials for structural use. By selecting strain rates that produce strength values in standard type tensile tests that are indicative of the creep behavior of the alloy for the time period under consideration, a rapid screening of many alloys can be made by using short time tensile properties. This technique is especially true for alloys with complicated, varying heat-treat cycles, variable response to fusion welding conditions, and other variables that make a complete creep test documentation too costly and time consuming.

The short time, elevated temperature tension, compression, and creep testing of metals have progressed far enough to determine the general pattern of behavior exhibited by materials under short-time test conditions. The work still to be accomplished encompasses documenting the behavior of alloys of interest to specific designs; integrating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the effects of the surrounding environment on the temperature load behavior determined in tests such as: integrating tension, compression, vibration and constant load application into one trajectory simulation type of test; and developing analytical tools to be able to predict the combined load behavior of materials.

Based on SAE Paper No. 104T, by Alan V. Levy, Hughes Tool Co., and Eugene C. Bernett, The Marquardt Corp. Society of Automotive Engineers, 485 Lexington Ave., New York 17, N. Y.

Quality Control Applications in the Job Shop

The job shop quality-control program must be geared to evaluate types of operations machine by machine. It cannot be geared to evaluate each quality characteristic on each part or product produced by each type of operation by machine. Evaluation of each type of operation rather than each quality characteristic permits the use of one fraction defective control chart which combines all the different kinds of quality characteristics and all the different part numbers. This is a "mixed up" kind of quality-control chart; however, it will provide a management with a record which the department foreman will find most helpful in isolating assignable causes which can be corrected to improve the over-all quality of work produced. This kind of control chart has certain recognized shortcomings:

1. It does not permit defects of different degrees of importance to have more or less effect upon the chart index of quality
2. It does not provide a sensitive statistical control which calls for corrective action as promptly as would be possible with standard control chart techniques
3. It does not always point clearly to the source of trouble when it occurs.

On the other hand, this "mixed up" kind of machine control chart has important advantages:

1. Simplicity
2. Low cost of records and charts
3. It will generally, in time, show up significant differences in worn out machines or tools
4. It will show up employees with bad work habits
5. It will eventually show up bad design tolerances on particular parts
6. It may even show up significant differences between vendors; however, special supplementary studies are generally required to get this picture.

These advantages outweigh the disadvantages to justify compromise.

Job shop quality control consists of charting each machine on one continuous fraction defective control chart. Data is recorded through each eight hour shift. Plotting is made only once each shift for each machine. The chart shows the date, employee, machine, number of inspections, number of defects observed and percentage. Part numbers should be noted only when a defect is observed. It is advisable to accumulate the results from start to end of each week so that the last plotting on Friday is actually the weekly average situation. It is not advisable to run accumulative fraction defective charting of this type beyond the one-week period.

These machine charts should be summarized by type of machine group each week. This gives management total performance for lathes, screw machines, headers, plating, stamping, etc.

Percent defective is always compared with a "standard" or "allowed" number of defects computed from past performance. The foreman is requested to report on defects that exceed the allowed number. The foreman's report must re-

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sult in corrective action or the system will be fruitless.

The quality-control floor inspector should code each observed defect as to its cause. This on-the-spot classification is used to prepare a periodic summary for administrative use. Management action should not be taken on only the evidence presented by these summaries since they represent on-the-spot classification. Special investigative statistical studies combined with standard average and range charts should be applied for only limited trouble periods. Trouble periods are indicated when defects have exceeded the upper probability limits on the fraction defective machine charts or the summary charts. As soon as the combined picture returns to a satisfactory low-defect level, variables control charts, average and ranges, and/or frequency distribution analyses should be discontinued.

Modern quality control can be profitably applied to almost any "job shop" production in both large and small plants. It may be used as a process control program or as an acceptance sampling system. In either system, quality control will measure the attitudes of the people and evaluate the method, and provide machine and material supplied by management. It will provide management with a system to attain quality-control-objectives in an economical way.

Based on a paper by W. E. Jones, Management Controls, presented at the 13th Annual Convention of American Society for Quality Control, Room 6197 Plankinton Bldg., 161 West Wisconsin Ave., Milwaukee 3, Wis.

TO REQUEST COMPLETE PAPERS WRITE TO THE ADDRESS AND ORGANIZATION INDICATED AT THE END OF EACH ABSTRACT

Quality Control Engineering in New Design

A close team relationship must exist between the quality control engineer, the product design enginer, and the process design engineer for evaluation of product quality prior to the start of manufacture. The quality control engineer can contribute toward the analysis of the product design for conditions that might cause quality problems. He does this on the basis of his experience and knowledge obtained from previous similar designs.

The quality control engineer can also assist in identifying the environments and end-use conditions against which the product should be evaluated. Analysis of field results and customer complaints with earlier models equips him with this knowledge.

Although the design engineer usually has the primary responsibility for evaluation of prototype quality, the quality control engineer's testing experience may assist in providing helpful suggestions. The quality control engineer also benefits from a close working relationship during prototype testing. It provides him with valuable background experience toward planning in-process testing of the manufactured product.

Based on a paper by William J. Masser, General Electric Co. presented at the 13th Annual Convention of American Society for Quality Control, Room 6197 Plankinton Bldg., 161 West Wisconsin Ave., Milwaukee 3, Wis.

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An Organized Approach To Reliability

Reliability can only result from a systematic process of control. The planning function is therefore a factor of major significance and the specification should clearly reflect this. Essentially, it should require that the contractor prepare a written description of his reliability program and the procedures to implement this program. The program should include a time-phased plan for attaining the quantitative reliability requirements contained in the contract and the manner in which the contractor will demonstrate attainment of these requirements.

In addition to fulfilling a basic need of the contractor, the written program and procedures represent a fundamental element in conducting surveillance on the part of the government and would promote better understanding between the government and the contractor.

The specification should require preliminary and continuing studies to establish as early as possible and to revise, as necessary, quantitative reliability goals for systems, sub-systems, and functional performance limits and the environmental conditions under which the goals are to be achieved. These studies should cover all phases, from design goals through fabrication, testing, transportation, storage, maintenance and flight. They should determine the possibilities of trade offs of such parameters as weight, volume, performance, safety, storage life and producability versus reliability.

Based on a paper by Errol J. Lancaster, Ballistic Missile Center, Air Materiel Command, presented at the 13th Annual Convention of American Society for Quality Control, Room 6197 Plankinton Bldg., 161 West Wisconsin Ave., Milwaukee 3, Wis.

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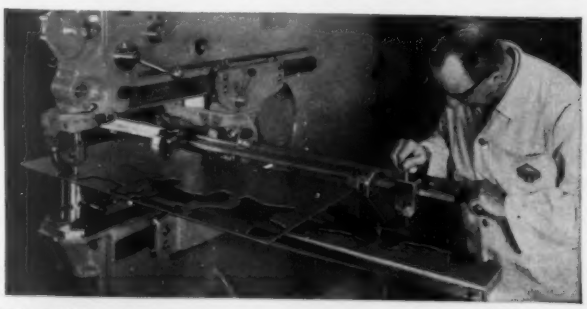

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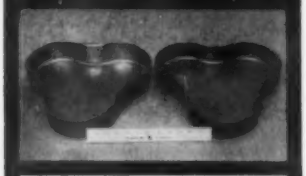

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Machine Capability—A Tool for Builder and User

The measurement of machine capability applies the science of statistics to process variations. No production process ever produces pieces that are exactly alike. There is some inherent variability which can never be eliminated. These inherent variations are usually small in magnitude but are large in number. The total amount of basic variability in a given machine tool process depends upon such uncontrollable variables as piece-to-piece hardness, environmental temperatures, minute deflections in the machine, periodic machine vibrations, runout in the spindle bearings, etc. All of these variables combine in a random manner to cause small variations in the product. Such variations, therefore, result from a large number of contributory causes, no one of which is comparable to the combined effect of all and which are just as likely to produce positive as negative deviations from the mean of all the measurements taken. A study of the statistical properties of these variations shows that they follow certain basic laws described by the theory of probability.

A machine tool which is functioning within the mechanical capabilities built into it and which is not being influenced by assignable causes of variation will produce parts which show these small measurement variations. If a plot is made with measurement deviation from the mean as the abscissa and the frequency of occurrence of these deviations as the ordinate, the resulting histogram will approximate the so-called normal distribution law. A curve fitted to this histogram will be characteristic for a particular process on a specific machine. It is the dimension of this normal curve which defines capability.

In measuring machine capability for a particular process, it is necessary to study the statistical properties of the measurement data and to determine such basic statistics as arithmetic mean, variance, standard deviation, etc. and to make the proper corrections in the data so that the final answer will not include any measurement variation for which there is an assignable cause. Various statistical tests are useful in helping to make decisions regarding the presence or absence of assignable causes of measurement variation. These tests must be applied correctly and to the proper statistical situations or incorrect conclusions will be drawn from the results.

Based on a paper by David N. Smith, Jones & Lamson Machine Co. presented at the 13th Annual Convention of American Society for Quality Control, Room 6197 Plankinton Bldg., 161 West Wisconsin Ave., Milwaukee 3, Wis.

Preventive Maintenance at Work

The primary purpose of any maintenance activity is to minimize the manufacturing cost of the product without sacrificing quality or worker safety by the economical application of men, tools and material to protect facilities and increase productivity. Economics dominate maintenance activities. Perfect maintenance is too costly. Poor maintenance is too costly. Universal application of the principles of management and proven maintenance procedures will permit arrival at that optimum point where profits are greatest.

Preventive maintenance provides the framework for all maintenance activities and is applied to support the objective by insuring that facilities are in a condition to produce a quality product at the lowest possible unit cost. This is not necessarily the lowest possible total maintenance cost but is the maintenance cost which keeps the product cost at a minimum.

It is the task of preventive maintenance through planned, scheduled inspection, maintenance and overhaul to insure that equipment failures do not occur at an uneconomic rate. This concept of preventive maintenance stems from three factors:

1. That day-to-day repairs are required to keep facilities in safe and efficient operating condition
2. That repairs will fall into a repetitive pattern
3. That these repairs can be analyzed and a prediction made of what to do to prevent those which economically justify prevention.

Since no large scale prediction is perfect, and complete prevention is sometimes more costly than occasional failure, day-to-day repairs will always be required. Therefore, the basic relationship between the two practices is that the number and the cost of repairs are a measure of the effectiveness of preventive maintenance activity.

Preventive maintenance provides the framework for all maintenance activities. The guiding principle is that planned, periodic application of the correct maintenance service and life. The approach to this economic optimum is controlled by preventive maintenance and the desired result is:

1. A reduction in the total cost of maintenance
2. Increased production and fewer interruptions to operations due to equipment breakdowns and repairs
3. A level workload and a stabilized work force
4. A predetermined requirement for and a reduced inventory of materials and spare parts.

Preventive maintenance is systematic attention and analysis applied in economic amounts to insure proper functioning and to retard the rate of deterioration of physical facilities. Preventive maintenance activity includes:

Operating Maintenance: Properly operating, caring for, cleaning, and in specified cases, lubricating equipment. This may also include making small adjustments and correcting minor defects during the course of operations. This preventive maintenance will usually be done while equipment is operating.

Shutdown Maintenance: This intermediate segment of preventive maintenance work includes examining, checking, testing, partially dismantling, replacing consumables, lubricating, cleaning or other work short of overhaul or renovation. This preventive maintenance requires that equipment be shut down to accomplish the inspection or repair.

Preventive Maintenance Overhaul: Dismantling and examining equipment before breakdown occurs and replacing or renewing components which have reached close to a theoretical maximum service limit. This preventive maintenance requires that equipment be shut down for longer periods of time to accomplish inspection or repair.

The level of maintenance is set by the nature, the quantity and the frequency of application of the above phases of preventive maintenance. The purpose of preventive maintenance is to achieve a "level of maintenance" on all facilities which enables the optimum production of quality product at the lowest unit cost.

Based on an address by J. F. Thorton, Phillips Petroleum Co. at the 11th Plant Maintenance and Engineering Conference. Copies of the complete talk are available from Banner and Greif, 369 Lexington Ave., New York 17, N. Y.

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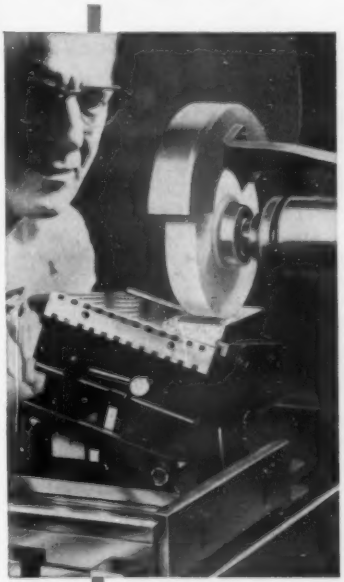

YOU don't have a Magna-Sine? You're paying for one of these Robbins sine plates anyway! Why? Because angular setups on machining, grinding or inspection operations, which require hours by other methods, take just minutes with a Robbins Magna-Sine. The cost of lost man-hours on just a few angular setups in your shop would pay for one of these precision magnetic Magna-Sines or non-magnetic sine plates.

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Using Robbins precision sine plates is fast, simple and sure—you eliminate V-blocks, angle plates and complicated "build-ups". A complete range of models and sizes are available to meet the needs of any shop, large or small. You're paying for a Magna-Sine, you should have one.

Catalog MS-58 describes the complete line of Robbins Magna-Sines and non-magnetic sine plates, send for your free copy.

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Selection of Methods and Instruments for Vibration and Shock Testing

Each program or single phase thereof should be requested and designed with some specific purpose in mind. Second, manpower, equipment and time must be reasonably appropriated for the furtherance of the test program. While this may seem as an easy way to avoid the multiple practical difficulties plaguing the program manager, it is also a convenient subterfuge to concentrate attention on the relatively simple technical problems. Third, it is necessary that any individual responsible for a shock and vibration program be given detailed design and operation data of the test item and connected equipment to an extent sufficient to predetermine the approximate test behavior. In particular the types of malfunction and failure should be available well before closing the "start" switch of the test exciter.

A test program will be judged adequate if it reaches the preset objectives within reasonable limits of tolerance, it mobilizes not more than the essential of manpower, equipment, processing time and evaluation, it uses reasonably balanced power, bandwidth, detection threshold, and processing accuracy levels, compatible with the test objectives and finally if it does not pretend to conclude more than what is physically contained in the test results.

In a broad sense, shock and vibration tests, as many others, are conducted in view of ascertaining that a given piece of equipment is suited for operation within specified environmental conditions. It is not easy to agree, even among specialists on the meaning of suitable operation, neither is it always possible to specify environment completely and unambiguously. In practice, shock and vibration tests are conducted with one or combination of the following objectives:

1. Proof of compliance with performance specifications. MIL-SPEC type test programs are often performed for no other reason than part of contractual obligations; there is little or no evidence in some cases that the test conditions are realistic in terms of the true operating environment.

2. Proof-of-design tests aim at submitting the test assembly prototype to some predetermined vibration or shock program and at obtaining proof that a given set of deviations do not exceed a limit specified in advance.

3. Proof of workmanship tests are usually performed on some proportion of production units whose design has been found acceptable on basis of pre-

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vious test programs. Test programs often exceed operational requirements with the hope of eliminating the statistically abnormal "catastrophic" failures occurring in the first few percent of the expected mean endurance life.

4. Parameter adjustment tests are a primitive but most effective computation method to establish optimum values of support compliances, transfer characteristics, etc., especially in locations or components not easily accessible to analysis.

5. Endurance life prediction tests are a somewhat more sophisticated version of proof-of-design tests. Not only the tolerable levels of deviations are to be established but the results are to be processed in terms of assumed damage accumulation criteria in order to obtain a rational basis for endurance life prediction.

Based on SAE Paper No. 100V, by Thomas P. Ronn, M.I.T. Society of Automotive Engineers, Inc., 485 Lexington Ave., New York 17, N. Y.

Research and Development Techniques in Maintenance

To insure more adequate research effort, the split project system is recommended for best results in equipment or process engineering. In this procedure two engineers are assigned to each project, one responsible for the research and the other for the development aspects of the project. At the start the research engineer investigates the field, studies the literature, makes sketches for test equipment and supervises the tests, and keeps the development engineer posted on the progress of the work which he will later translate into the final industrial installation.

When management feels that research has attained enough reliable and practical information to justify transferring the project to the development stage, the development engineer assumes responsibility, but the research engineer remains a consultant to resolve any research problems that arise as the various details are brought to final design. Under this method there is less chance that some item of importance will be overlooked, as is so often the case when only one man has full responsibility, and in addition both the research and development aspects of the problems inherent in the project will be reviewed through a discussion between men with different points of view. If, for example, an organization with two engineers has four projects in process, it is common practice to assign each engineer two projects; under the split project system it may be that each engineer will be assigned the research aspects of two projects and the development aspects of the other two. In this way all the engineering talent of the organization is brought to bear on all its current projects.

Based on an address by J. H. Pfau, Philip Carey Mfg. Co. delivered at the 11th Plant Maintenance and Engineering Conference. Copies of the complete talk are available from Banner and Greif, 369 Lexington Ave., New York 17, N. Y.

Total Quality Control

Determination of quality—and, consequently, of quality cost—takes place throughout all stages of the production cycle. The twin objectives of better product quality and lower quality cost cannot be achieved by concentrating upon any one phase of the cycle alone—inspection, design engineering, reject trouble-shooting, operator education, or statistical analysis—important as each phase is in its own right.

Doing the job adequately requires instead, a program of total quality control. Therefore, it is proposed that total quality control—through quality control engineering—not only is the function which can do the quality control job needed by American business today, but it is also the activity that is geared to the quality job that will face us tomorrow. As an inevitable corollary, it is the quality control concept that is most acceptable to American business: because it is an integrated whole; because it operates at lower costs; because it contributes in major degree to business profitability; and because it comes to grips with product quality and quality cost problems as top management sees these problems.

Based on a paper by A. V. Feigenbaum, General Electric Co., presented at the 13th Annual Convention of American Society for Quality Control, Room 6197 Plankinton Bldg., 161 West Wisconsin Ave., Milwaukee 3, Wis.

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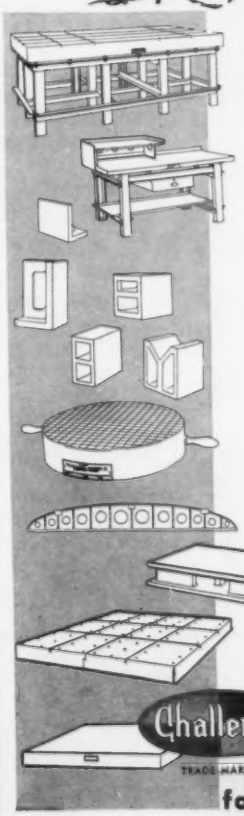

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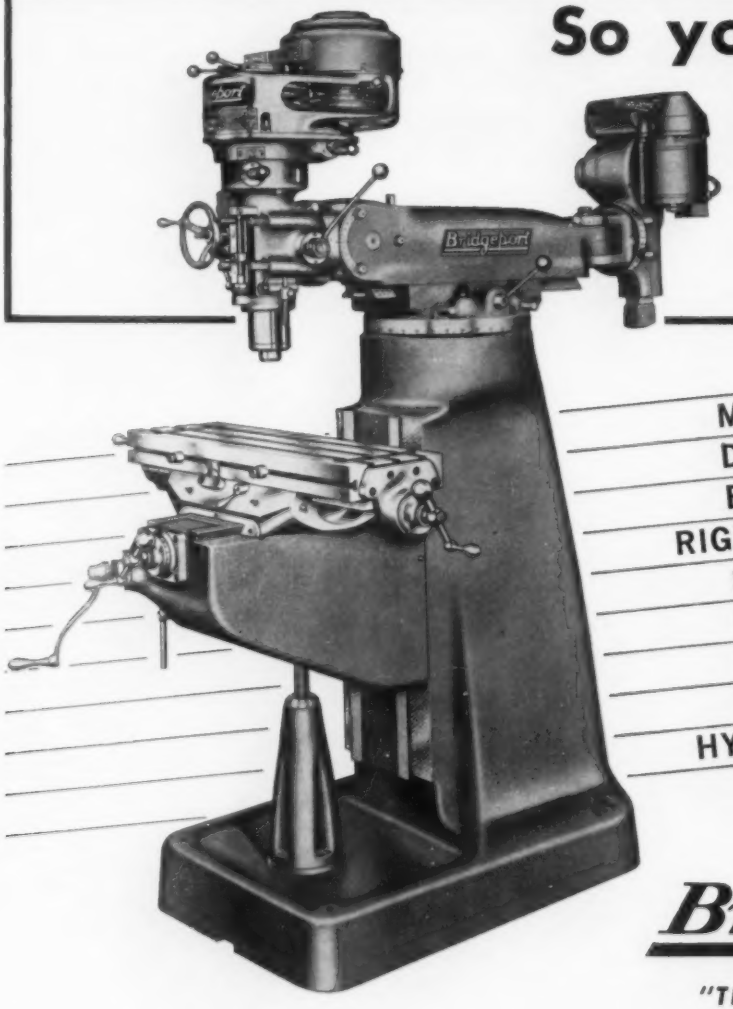

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. . . small shops as well as large are assured attractive returns on a modest investment within the reach of all.

. . . a machine where price has been maintained on a remarkably even keel under constantly rising costs of manufacture and where quality, capacity and range of operations have been stepped up and extended year after year.

. . . where versatility has been extended through constant development of attachments.

These are a few of the many reasons why BRIDGEPORT can logically stress "VERSATILITY" and why the "Most for the Least" is an accurate way to describe this outstanding machine tool.

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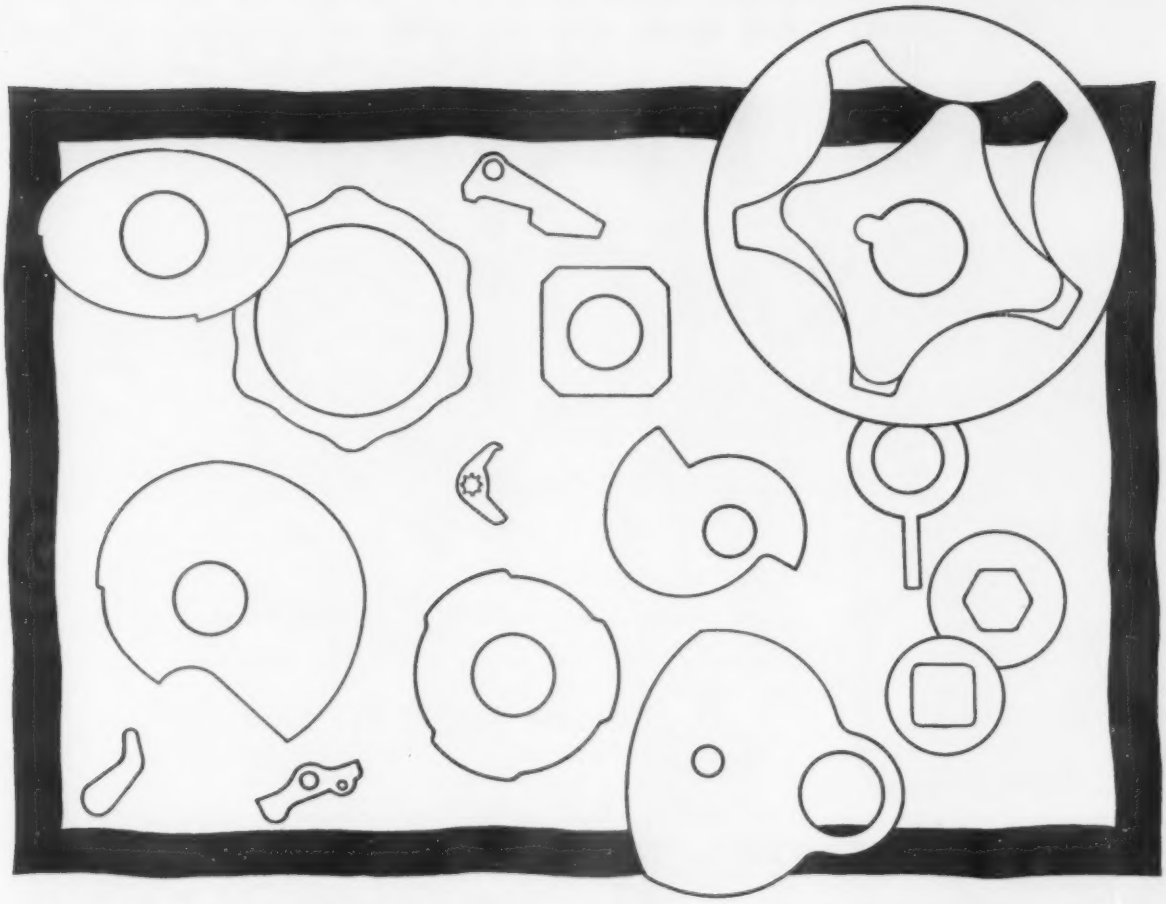
Manufacturers of High Speed Milling Attachments and Turret Milling Machines



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. . . a lot of them are in production, cutting parts having non-involute shapes of various kinds. Many designers take full advantage of the versatility of the Gear Shaper by designing odd-shaped parts that can be easily and economically generated by merely using special Fellows cutters and fixtures on their standard Fellows machines.

The almost unlimited variety of work includes square and elliptical shapes, cams, pawls, pump rotors, etc., both internal and external.

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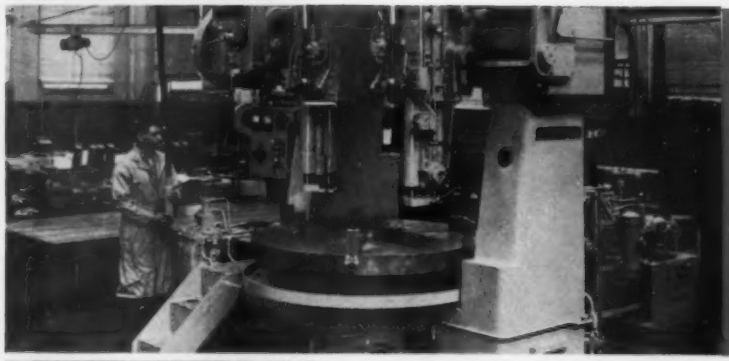

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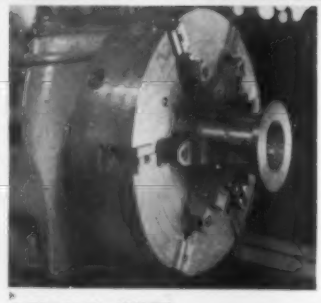

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Union "Know-how", which has produced chucks from the sixty-six incher shown above to the three inch size, is as close to you as your nearest Industrial Distributor. Whatever your holding problem, call your distributor today and ask about dependable top precision Union Chucks . . . They'll solve your problem and keep it trouble free!

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Tough cutting jobs are easier with new DIXIE tools

New Dixie Tools are now available for cutting materials currently used in the manufacture of rockets and missiles — such as special fibre glass, phenolic plastics, epoxy resins, ceramics and others.

Specially designed routers can be supplied by Dixie for the toughest and most unusual jobs. Dixie also manufactures the finest carbide tools for drilling, milling and hole sizing in these new materials.

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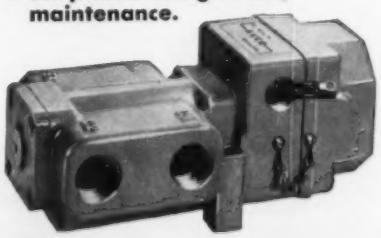
AIR VALVES from stock

A complete range of two, three and four-way valves in sizes ¼", ⅜", ½", ¾".

- High quality—Low cost.
- Compact—Light weight.
- Fast delivery from stock.
- Simplified design—Easy maintenance.



New foot-mounted series available in single or double solenoid models.

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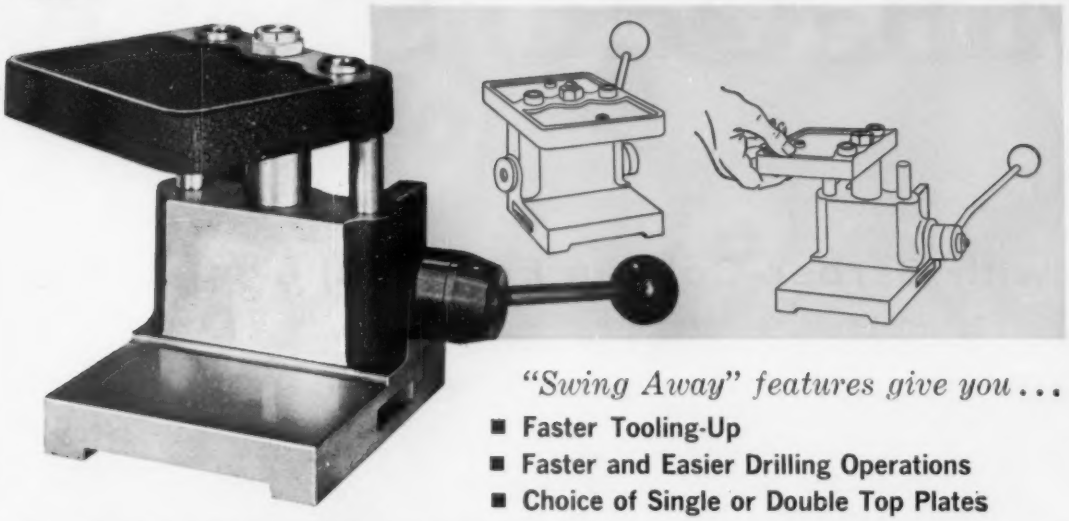
tool quickly for long or short runs!

ABC LIFT SWING DRILLING FIXTURES

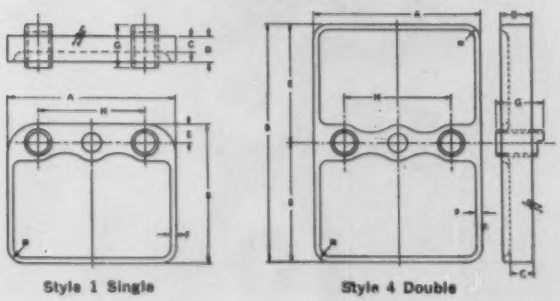


"Swing Away" features give you . . .

- **Faster Tooling-Up**
- **Faster and Easier Drilling Operations**
- **Choice of Single or Double Top Plates**

INTERCHANGEABLE TOP PLATE ENGINEERING DATA

Top Plate Dimensions



Style 1 Single — Style 4 Double

Top Plate Sizes

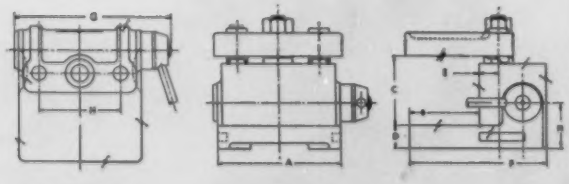
Top Plate Style	Top Plate Number	A	B	C	D	E	F	G	H	R
1	2201	2⅜	2⅛	½	½	7/16	—	¾	1½	5/16
4	2204	2⅜	3⅛	½	½	1 1/16	—	¾	1½	5/16
1	3201	3⅛	3 7/16	½	½	⅛	—	1	2½	⅛
4	3204	3⅛	5⅛	½	½	2 13/16	—	1	2½	⅛
1	4201	4⅛	3⅛	½	¾	⅛	3/16	1	2½	½
4	4204	4⅛	6¼	½	¾	3⅛	3/16	1	2½	½
1	5301	5½	5	¾	1	⅛	3/16	1⅛	3½	⅛
4	5304	5½	8¼	¾	1	4⅛	3/16	1⅛	3½	⅛

Larger sizes and other style single top plates available.

IMPORTANT: When ordering Complete Assembled Lift Swings, specify first 3 digits of Base Number and 1 or 4 to indicate the style of Top Plate desired. EXAMPLE: LS-3221 = 3220 Base with 3201 (Style 1) Top Plate.

FIXTURE BASE ENGINEERING DATA

Fixture Base Dimensions



Top View (Top Plate Removed) — Front View — Side View

Fixture Base Sizes

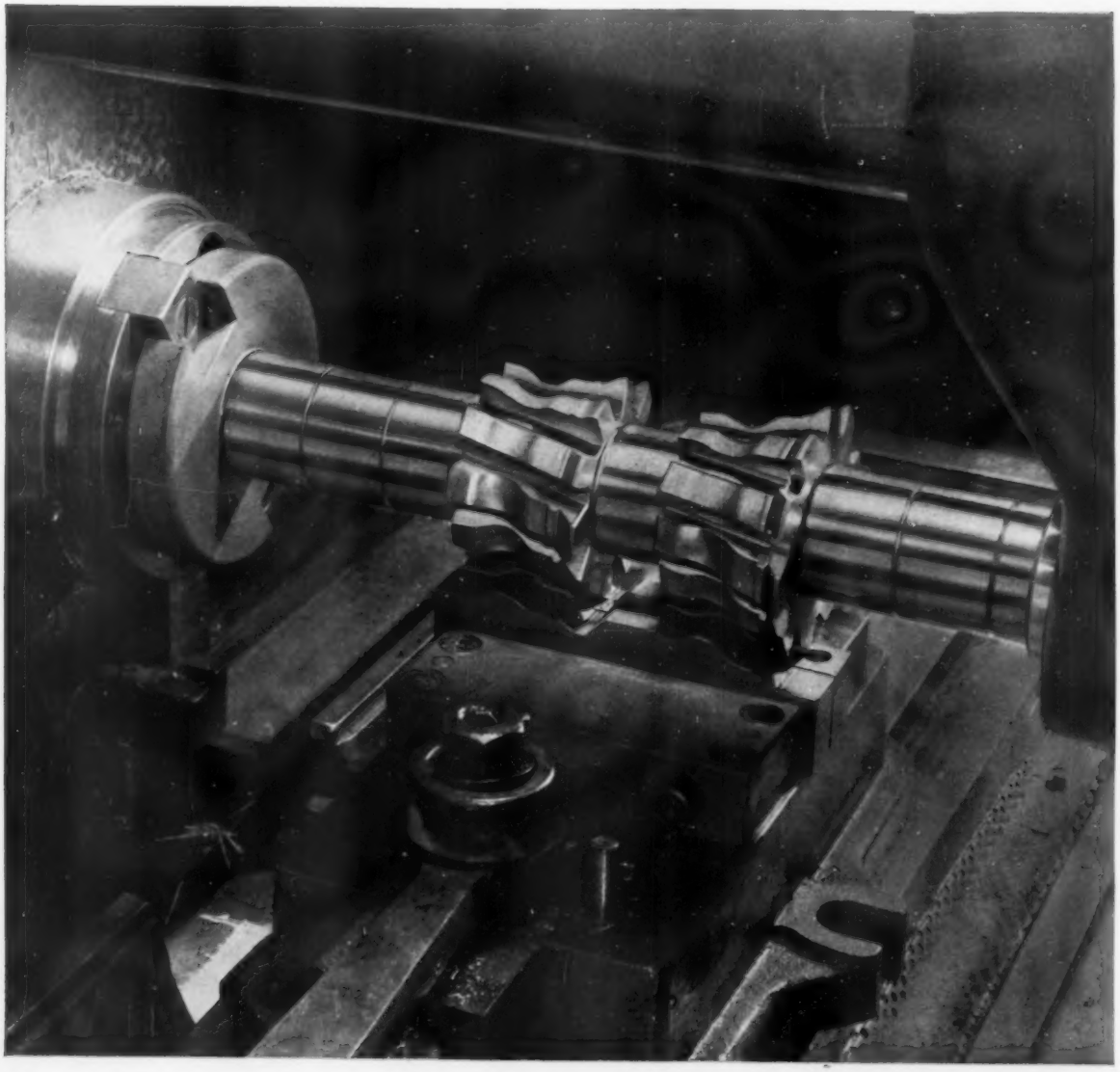
Lift Swing Base Number	A	B	C	C Shut suggested max. clamp	C Open	D	E	F	G	H	R
2220	2⅛	1⅛	1½	1¾	2¼	1	½	3⅛	3¼	1½	1 9/16
3220	3⅛	2⅛	2	2⅜	3	1	⅝	4½	5	2½	1 1/16
4220	4⅛	2⅜	2½	2⅞	3½	1	⅝	5	5¾	2½	1¾
5330	5⅛	3⅛	3	3¾	4⅝	1	1	6¼	6¾	3½	2
5340	5⅛	3⅛	4	4¾	5⅝	1	1	6¼	6¾	3½	2
5350	5⅛	3⅛	5	5¾	6⅝	1	1	6¼	6¾	3½	2

Larger sizes available. For tooling suggestions and complete engineering data write for Catalog LS-58.

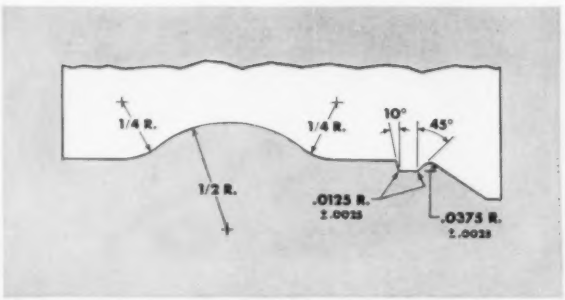
ACCURATE BUSHING COMPANY
443 NORTH AVE., GARWOOD, N. J.

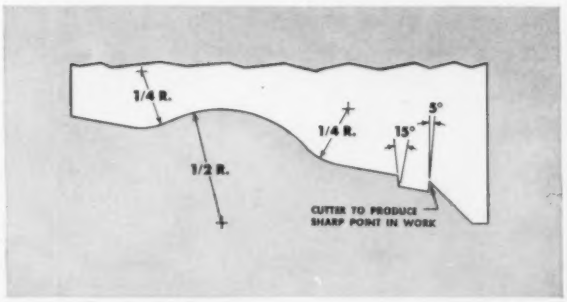
Mill Odd Shapes

...with Barber-Colman Form-Relieved Cutters



in One Operation





Two different pieceparts . . . complex forms . . . precision tolerances. All are combined in one milling operation, using Barber-Colman *unground*, form-relieved cutters.

These helical-fluted cutters are made interlocking to produce a sharp point, as shown on the drawing. Since they are of the form-relieved type, form can be maintained easily by sharpening the tooth faces.

But, the job of controlling work quality and production costs depends upon the fine points of cutter design and manufacture. In this case, for example, several difficult dimensions are held to ± .002 in. This means dimensional distortion and growth in heat-treating must be predicted accurately and compensated for in design. Sharpening, steel specifications, heat-treatment, and surface finish — all affect performance on the job. They are dependent entirely upon the capabilities of the maker.

Barber-Colman's modern new cutter plant is equipped with advanced engineering and manufacturing facilities to keep close watch on these important factors. For example, accurately ground form tools produce a smooth unground finish on the cutter teeth in the form-relieving operation. This assures maximum tool life by eliminating rough edges — a common cause of wear on the flanks. Also, because all Barber-Colman cutters are *index-sharpened*, your sharpening costs can be minimized. The job can be done on an automatic sharpener. Original tolerances are maintained easily throughout the life of the tools.

Cutter engineering service...

These five services become adjuncts to your own methods department when you submit a milling problem to Barber-Colman Company:

1. *Application engineering* — on-the-spot evaluation of milling problems by experienced tool designers.

2. *Design engineering* — highly specialized tool engineering, backed by electronic computer facilities for fast, accurate calculation of complex tooth forms.

3. *Metallurgical engineering* — specially selected steels and heat-treatment for your particular material and tool geometry.

4. *Manufacturing* — the most complete and advanced processes under one roof for producing exactly the right finish, highest accuracy, and *any* cutter style.

5. *Quality control* — optical master inspection, seven different control stations, and numerous separate inspections for individual cutters.

Barber-Colman Company

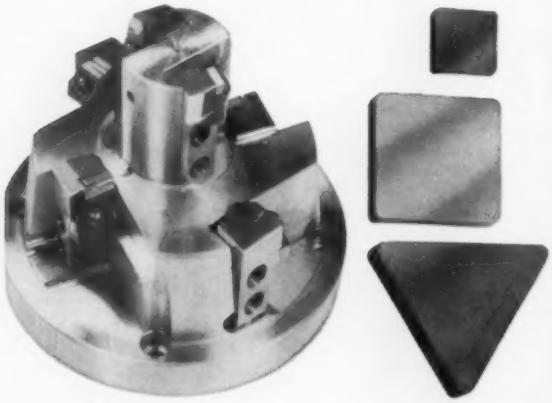
BARBER COLMAN

43 Loomis Street, Rockford, Illinois

Whether you want to combine operations, change processes, or just get more out of your tooling dollar, you can have a Barber-Colman field engineer at your desk for consultation by calling Rockford — TR 7-5741.

LEHMANN INDEXABLE-TIPPED BORING TOOLS

eliminate tool sharpening and re-setting!



DISPOSABLE INSERTS

You'll have less down-time on your boring machines when you "tool up" with Lehmann Indexable Bits. These tungsten carbide inserts, with multiple cutting edges are ideal for fast stock removal work. No time lost in sharpening or re-setting to adjust for wear.

Ask for quotations on Lehmann Boring Bars and Indexable Bits to fit your specifications.

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COLUMBIA TOOL STEELS

Confidentially, people who *make money* with non-deforming steel dies use EXL-DIE (Type O1) oil hardening steel

Product of Skilled American Workmen

Better think about "cookie cutter" dies

..They offer you time and cost savings up to 90%

- Shearing
- Blanking
- Punching
- Piercing

"Electromatic" Super Die Saw - 42 x 52" table, 50" Jig throat. Built in 4 sizes, 24" 30" 50" 74" throat

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Atlas straight steel rule cutting machine #3ACS

"Multiform" heavy duty bender #4HDC

YOU CAN MAKE STEEL RULE DIES FASTER, BETTER AND CHEAPER WITH RICHARDS' STEEL RULE INDUSTRIAL DIE-MAKING EQUIPMENT

No doubt about it . . . you can count on substantial reductions in production costs involving dies when you put J. A. Richards equipment to work in your plant. Fifty years of manufacturing experience as the originators and pioneer manufacturers of steel rule die making equipment backs up every one of Richards' complete line of "Multiform" Heavy Duty Benders and Cutters, and "Electromatic" Precision Die Saws.

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Quick, jam-free assembly and disassembly, lasting accuracy, unlimited selection of sizes and styles! Add to these advantages the benefits of immediate service in every industrial center through Producto's growing network of 46 branch assembly plants and distributor warehouses...and you realize why "They all prefer Producto". • **A WEALTH OF DIE SET INFORMATION** is available to you, free, in the comprehensive, easy-to-use Producto Catalog No. 11, and in regular issues of *Die Set Digest*. Write today for these valuable aids.

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Now! ... New Complete Line of B&S Thriftmills® at 20% Savings!

20% Lower Initial Cost and Amazing Production Dividends– Puts End Mills in "Throw-Away" Tool Class

New, and money saving–the four flute, single end Thriftmill was introduced a year ago with resounding success. Now, an expanded line of two and four flute single and double end B&S Thriftmills is available to make the initial 20% savings possible on practically all conventional end milling operations.

Shop tested for over a year on profiling, slotting, peripheral milling and many other general end milling operations, the new B&S Thriftmill has outperformed higher priced, competitive end mills. Superior microfinish on bottom and sides of slots, as well as on the periphery of profiling cuts, and more production before resharpening are only a few of the dividends this new B&S End Mill has added to the low, low initial Thriftmill cost.

Why the Superior B&S Thriftmill® Costs Less..

MADE IN U.S.A. by Brown & Sharpe

When most other metalworking costs are rising, why is the price of the Thriftmill lower?

The reason–it is a new exclusive design. Made in U.S.A., a product of B&S research and progressive engineering. Because of extreme simplicity of design, these End Mills can be produced faster, more efficiently and, therefore, cost less.

Demand for the four flute, single end Thriftmill was so phenomenal and the new tool's performance so excellent that large volume production has lowered manufacturing and distribution costs.

INDUSTRIAL DISTRIBUTORS THE RIGHT HAND OF PRODUCTION

Available through your local Brown & Sharpe distributor

Thriftmill produces superior microfinish on tough alloy test piece. Note efficient chip formation.

Shop tests prove up to 3½ times more production with New B&S Thriftmill®

½" Thriftmill cuts 54" slot in oil hardened tool steel, Rockwell C-18.

TWO FLUTE • SINGLE END HELICAL FLUTE • STRAIGHT SHANK

For Cutting most conventional materials

TOOL DESIGN—Two flute, 30° helix angle, 10° rake, right hand cut. Eccentric relief. Shank same diameter as cut.

TOLERANCES—Flute dia., +.000 −.005; Shank dia., +.0000 −.0005.

TOOL FEATURES—Ground from solid metallurgically tested high speed steel. Meets demanding production requirements with outstanding economy and lowest initial cost.

PRODUCTION USE—For virtually all conventional end milling operations, profiling, slotting and peripheral milling. This versatile tool can even be modified to plunge cut when necessary.

SIZES—⅛", 3/16", ¼", 5/16", ⅜", ½"; all "standard" from off-the-shelf stock.

TWO FLUTE DOUBLE END • HELICAL FLUTE STRAIGHT SHANK

For cutting most conventional materials

TOOL DESIGN—Two flute, double end, 30° helix angle, 10° rake, right hand cut, eccentric relief.

TOLERANCES—Flute dia., +.000 −.005; Shank dia., +.0000 −.0005.

TOOL FEATURES—Ground from solid metallurgically tested high speed steel. An extremely rigid general purpose tool for economical production. Lowest initial cost.

PRODUCTION USE—For virtually all conventional end milling operations, profiling, slotting and peripheral milling. This versatile tool can even be modified to plunge cut when necessary.

SIZES—⅛", 3/16", ¼", 5/16", ⅜", ½"; all "standard" off-the-shelf stock.

FOUR FLUTE SINGLE END • HELICAL FLUTE STRAIGHT SHANK • For cutting most conventional materials

TOOL DESIGN—Four flute, 30° helix angle, 10° rake, right hand cut. Eccentric relief. Shank same diameter as cut.

TOLERANCES—Flute dia., +.000 −.005; Shank dia., +.0000 −.0005.

TOOL FEATURES—Ground from solid metallurgically tested high speed steel. Recommended for superior performance and lowest cost end milling on most conventional applications.

PRODUCTION USE—For profiling, slotting and peripheral milling.

SIZES—⅛", 3/16", ¼", 5/16", ⅜", ½"; all "standard" from off-the-shelf stock.

FOUR FLUTE • DOUBLE END HELICAL FLUTE • STRAIGHT SHANK

For cutting most conventional materials

TOOL DESIGN—Four flute, double end, 30° helix, 10° rake, right hand cut, eccentric relief.

TOLERANCES—Flute dia., +.000 −.005; Shank dia., +.0000 −.0005.

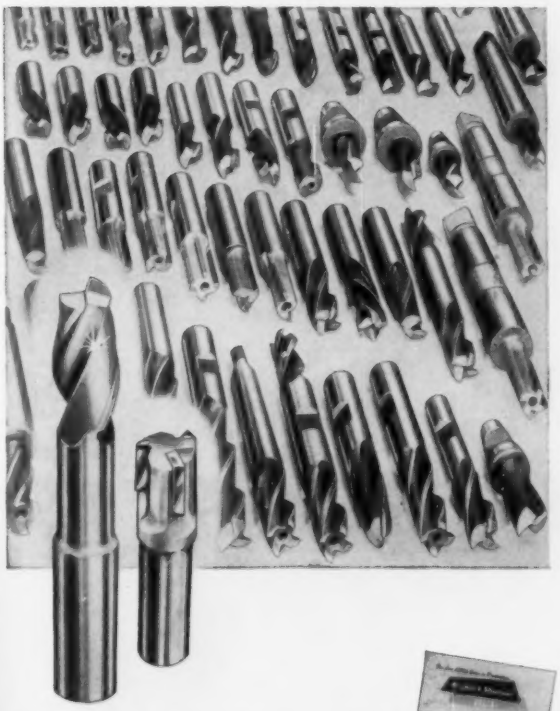
TOOL FEATURES—Ground from solid metallurgically tested high speed steel. An exceptionally rigid, general purpose tool recommended for economical milling of over 80% of end milling operations.

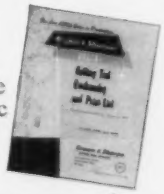
PRODUCTION USE—For profiling, slotting and peripheral milling.

SIZES—⅛", 3/16", ¼", 5/16", ⅜", ½"; all "standard" from off-the-shelf stock.

END MILL HEADQUARTERS!

Twenty-four new high production, low cost Thriftmills added to the B&S end mill line brings the total of different off-the-shelf "standards" to nearly a thousand.





End wonder, worry and wait . . . choose the right end mill for each specific job from the B&S "Condensalog" Write for yours today.

For that EXTRA Edge in Production!

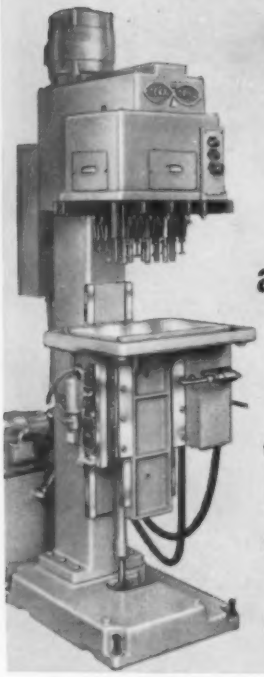
Brown & Sharpe

Cutting Tool Division
Brown & Sharpe Mfg. Co.
Providence 1, Rhode Island

VISIT OUR BOOTH — INTERESTING — NEW IDEAS — '60 — ASTE TOOL SHOW

Booth No. 1131

DEKA DRILL

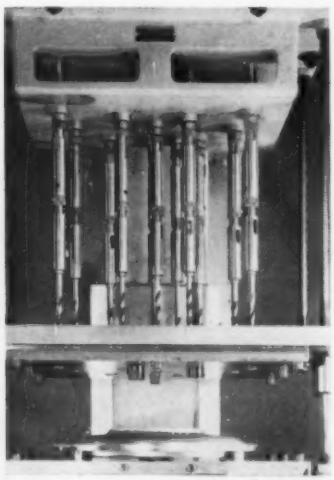


HYDRAULIC MULTIPLE SPINDLE DRILLING and TAPPING MACHINE

Send us one of your drilling or tapping problems for a free time study estimate. Find out how automatic cycle drilling and tapping with DEKA-DRILL can increase production and save time and money for you!

ELEVEN HOLES IN EIGHT SECONDS WITH DEKA-DRILL!

COMPANY: Continental Motors Corp., Detroit, Michigan.



OPERATION: Drilling eight 11/32" holes .480 deep and three letter "I" holes .780 deep in a malleable iron part.

TIME OF COMPLETE OPERATION: 16 SECONDS!

FLOOR TO FLOOR TIME: 32 SECONDS!

TECHNIQUE: Work piece is clamped automatically during drilling cycle by three pressure pads on bushing carrier mounted to top leaf of die-set. Bushing carrier and locating nest plate can be easily and swiftly removed and replaced to accommodate unlimited number of different work pieces.

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DUMORE Series 40 HAND GRINDER
Rating . . . ¼ Horsepower (Continuous Duty)
No-load speed . . . 35,000 rpm
Size . . . 10" long Weight . . . 3¾ lbs.
Collets . . . ⅛" and ¼"
Price . . . $175. FOB Racine
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GET A FREE DEMONSTRATION NOW . . .

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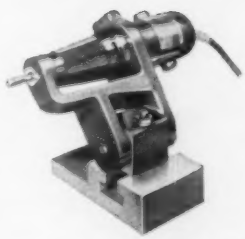

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permits rigid, vibrationless lathe mounting for high precision internal grinding with carbide burrs and mounted wheels.
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measures to millionths ... *in seconds!*

Combines the two proven principles of precision measurement—WEBBER Gage Blocks and the Leitz Measuring Microscope.

The revolutionary Webber Optical Height Gage enables the precision manufacturer to meet accuracy specifications within ±.000005" per inch of height. It saves time, speeds production, reduces errors, insures peace of mind. Requires no servicing — there is nothing to wear out.

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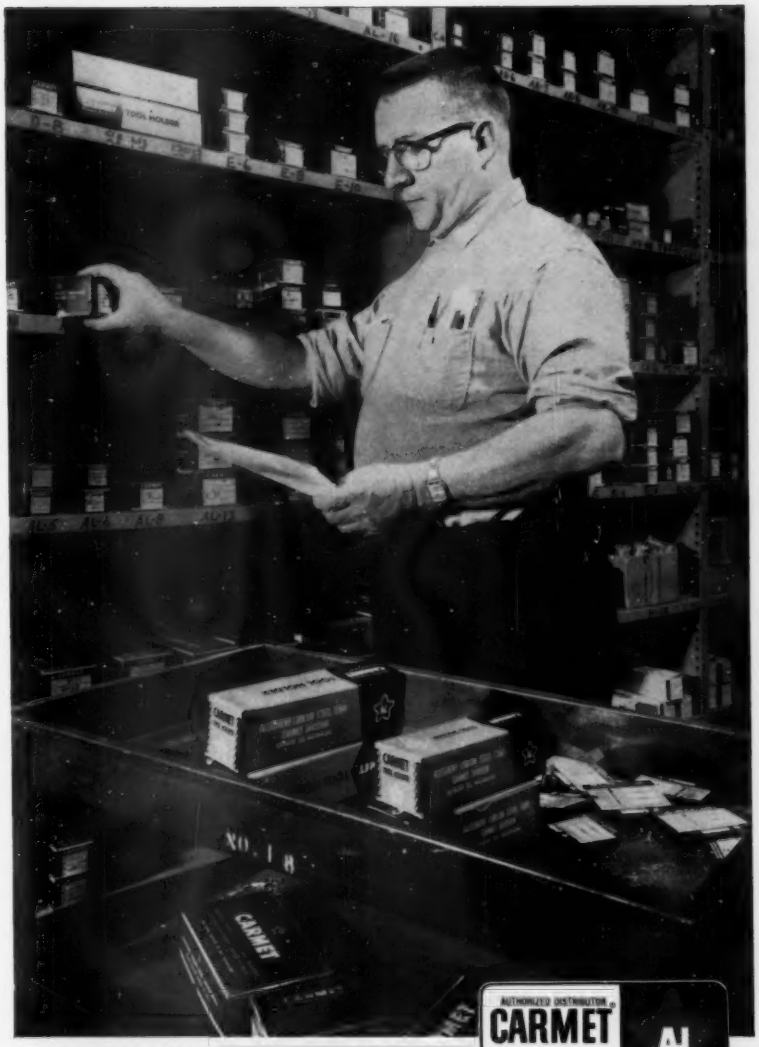
Off-the-shelf delivery of Carmet® Carbide Tools from your local CARMET Distributor



Over 75 distributors, coast to coast, display this sign—service in your own local area.

Keep your inventory of Carmet Carbide Tools at a comfortable level. Keep your working capital free for other needs. Your Carmet distributor carries the load—that's how he's set up to do business.

He carries your needs from the complete line of Carmet Carbide Tools in all grades and every style. He is geared to deliver your orders quickly—a phone call gets action.

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The Desk-O-Matic is the only fully adjustable, automatic, desk high drafting table that permits the operator to change angle of top or height of top, instantly, without moving from his position at the front of the table. *No other drafting table provides this convenience.*

Also, this table has counterbalance adjustments to insure consistent smooth operation of changes in both top height and tilt, and to compensate for weight added to top by drafting machine, light, and other equipment. The Desk-O-Matic drafting top holds steady regardless of height or angle position.

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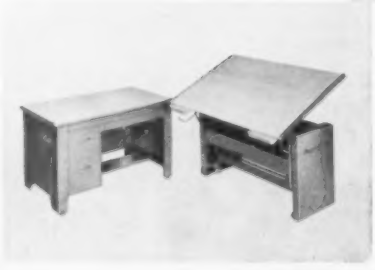

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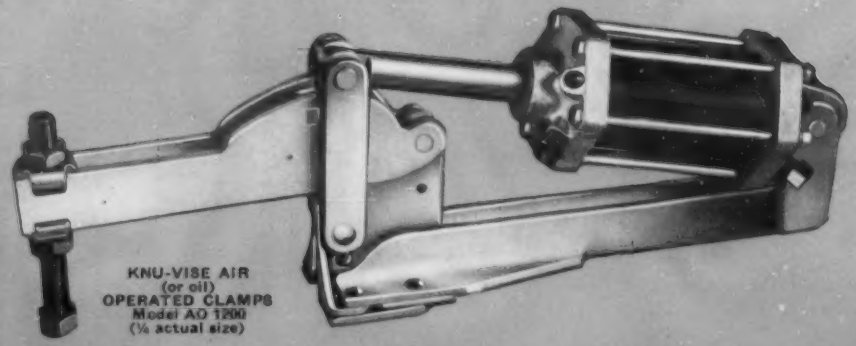
MAYLINE

Give tough clamping jobs the air



KNU-VISE AIR (or oil) OPERATED CLAMPS Model AO 1200 (¼ actual size)

...and speed production

...reduce operator fatigue

...improve quality control

✻ **In the aircraft industry—**
Knu-Vise air-operated clamps are used for holding air frame components during drilling operations.

✻ **In the refrigeration industry—**
More than 100 refrigerator inner door panels per hour are vacuum formed on an automatic machine using Knu-Vise air clamps.

✻ **In the automotive parts industry—**
A fixture using Knu-Vise air clamps holds center hubs for arc welding into housings for automatic transmissions.

✻ **In the construction industry—**
Knu-Vise air clamps are used on a work fixture for bonding galvanized steel sheet to steel channels.

✻ **In the truck industry—**
Truck cowl and plenum assemblies are placed in position, clamped and spot welded in 60 seconds on a special fixture using Knu-Vise air clamps.

✻ **In the automobile industry—**
Sedan roof panels are clamped on a fixture and 47 holes are simultaneously drilled. Knu-Vise air clamps help develop a production rate of 67 jobs per hour.

These are just a few of the many applications of Knu-Vise air-operated toggle action clamps used throughout industry. There are many hundreds more where Knu-Vise hand-operated clamps, pliers and C-clamps are standard equipment. Lapeer makes clamps in miniature sizes as well as big, brawny models for tough jobs. Lapeer clamping engineers can give you valuable assistance and are glad to discuss your clamping problem at any time. Write today for full information.

Manufacturers of more than 150 models of manually and air-operated clamps and pliers

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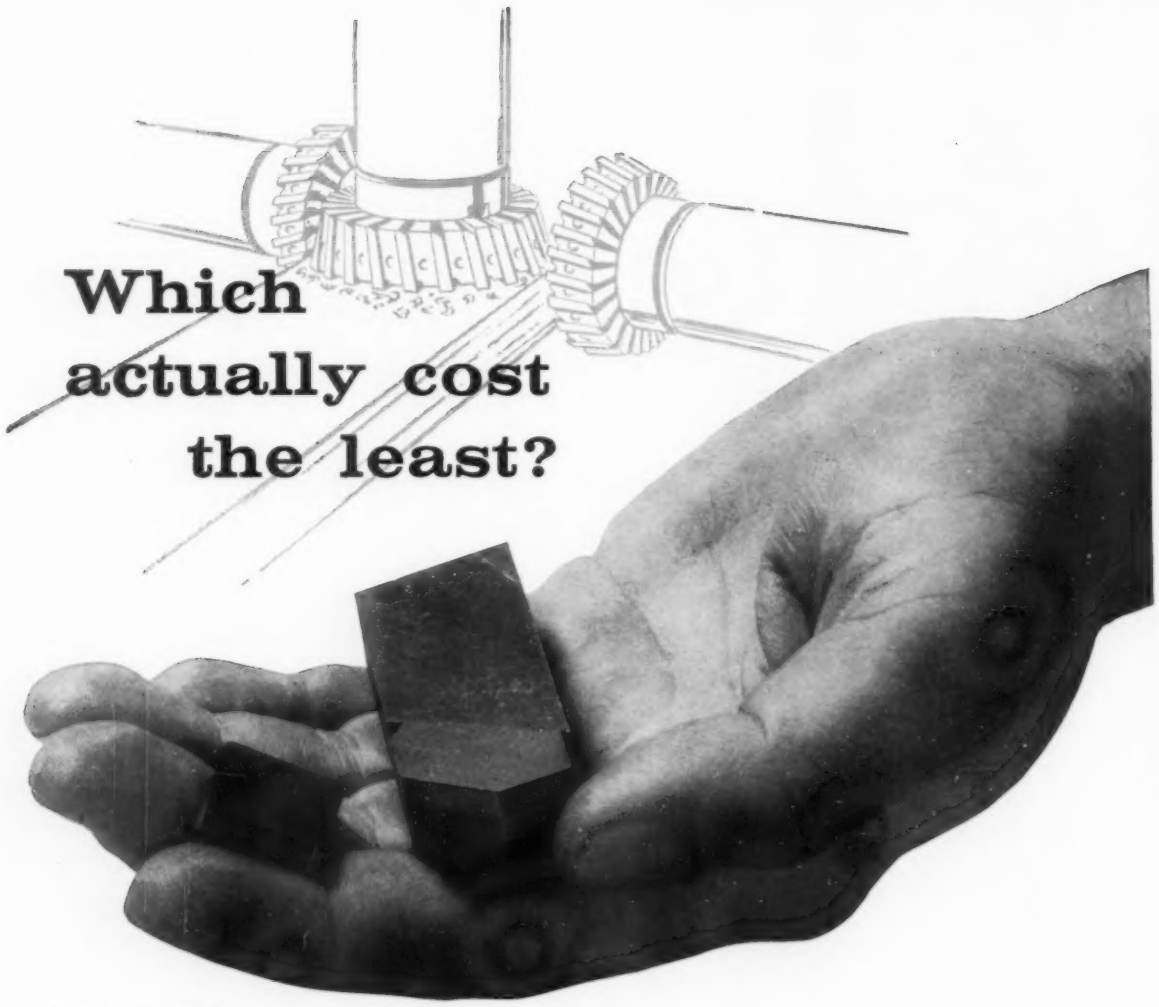
1131 Pettit Road, Burlington, Ontario

Which actually cost the least?



LOOK TO INGERSOLL FOR THE ANSWER

There's a place for each. Some say the throw-away offers the lowest-cost edge. Others prefer the tipped blade for the same reason. Both are in general use.

Analysis of work to be done, of the machine assigned to the job, and of the cutter itself will determine what blade is best. That's why many firms rely on Ingersoll's help in arriving at economical solutions to cutter problems.

For efficient, low-cost metal removal, let an Ingersoll representative make a preliminary survey. It will cost you nothing . . . may lead to important savings. Ask a representative to call, or write for the booklet, "Ways to Reduce the Cost of Chips." Address Dept. K-68.

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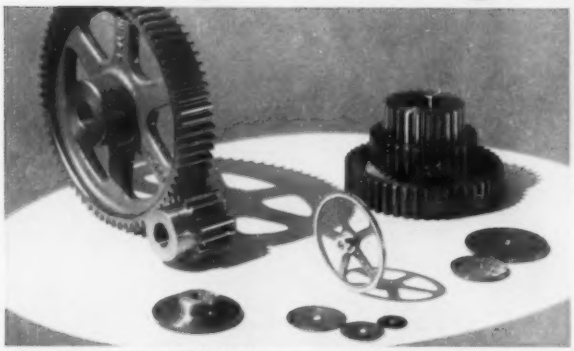
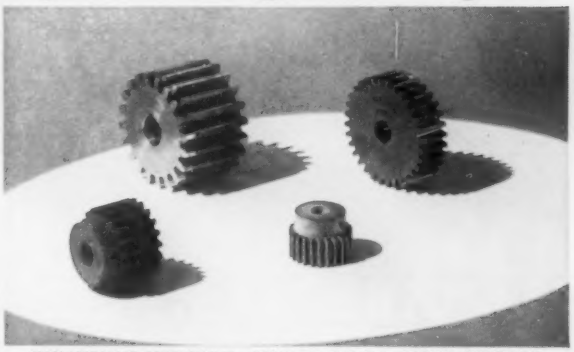
Design around gears you can get today

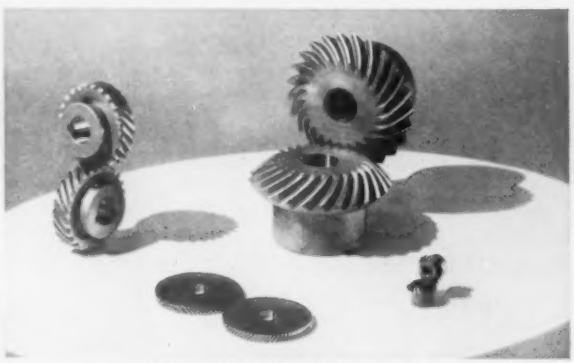


SPUR GEARS — STEEL, IRON, BRASS 14½° and 20° P.A. .208" to 40" P.D.



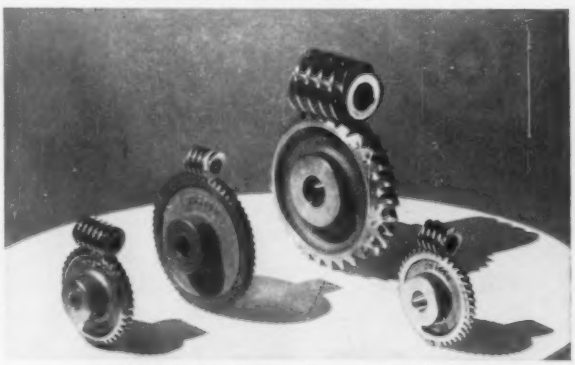
NON-METALLIC SPUR GEARS 14½° and 20° P.A. .938" to 6.667" P.D.

BEVEL and MITER GEARS Steel, Iron, and Brass 20° P.A. .312" to 14" P.D.



STEEL SPIRAL MITERS 1" to 5" P.D.
HELICAL GEARS Steel and Bronze .333" to 6" P.D.

RACK • PINION WIRE Steel and Brass 14½° and 20° P.A.
PINIONS • INTERNAL GEARS



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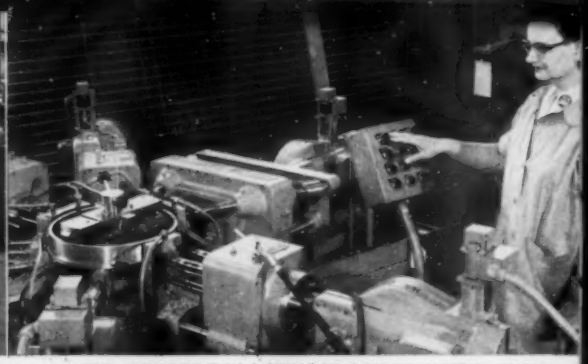

EASY OPERATION FROM A SIMPLE PUSH BUTTON CONTROL STATION.

EDLUND CAM FEED UNITS SELECTED BY RAYTHEON FOR SPECIALIZED DRILLING

EDLUND CAM FEED UNIT MACHINES are designed to individual order. At RAYTHEON'S Missile Systems Division Plant, Andover, Mass., they are used on parts for the Hawk Missile. By utilizing specially constructed multiple heads with angular spindles—a New concept in this type of work—these machines accomplish difficult drilling, reaming, tapping, spot facing, and countersinking operations. Operating in any position, the units can be used in single or combination batteries. The infinite adaptations of EDLUND CAM FEED UNIT MACHINES pay off in faster production and reduced drilling costs.

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EDLUND CAM FEED UNIT MACHINES FEATURE:.

1. The Advantages of Positive Cam Feed.
2. One Man Operation— by Electric Control.
3. Speeds from 310 to 3800 rpm., and Maximum Cam Strokes of 2½" (No. 62) and 3" (No. 125).
4. Adaptable to Angular Drilling Operations.
5. Simple Jig Set-up gives Precision Operation.
6. Numerous Drilling Operations can be Performed Simultaneously.

MMT=PE — MODERN MACHINE TOOLS = PRODUCTION EFFICIENCY

EDLUND
MACHINERY COMPANY,
Cortland, New York
Division of Harsco Corporation

EDLUND CAM FEED UNIT MACHINES DOING INTRICATE DRILLING DURING THE MANUFACTURE OF HAWK MISSILES.

EDLUND CAM FEED UNIT MACHINES— ENGINEERED TO SOLVE YOUR SPECIALIZED DRILLING PROBLEMS

FOR PRECISION DRILLING AT RAYTHEON
IT'S THE EDLUND MODEL 2G VERTICAL GUN DRILL

RAYTHEON'S MISSILE SYSTEMS PLANT, ANDOVER, MASS. USES THE EDLUND MODEL 2G GUN DRILL FOR ACCURATE EFFICIENT DRILLING IN HARD TO WORK METALS.

When your company, like RAYTHEON'S Missile Systems Division Plant, Andover, Mass., requires drilling with extremely close tolerances and precise accuracy, the EDLUND MODEL 2G VERTICAL GUN DRILL is the answer. This machine can cut cost and speed work with the elimination of secondary operations. The EDLUND MODEL 2G VERTICAL GUN DRILL offers precision drilling of odd shaped parts. It is ideal for firms doing intricate work in aircraft, missiles, electronics, or other specialized fields.

The EDLUND MODEL 2G VERTICAL GUN DRILL Offers These Features:

1. The Most Economical Gun Drilling Machine on The Market
2. TRUE Holes with a FINE Finish—2 to 32 Micro Inches
3. Accurate Drilling of ALL Types of Material
4. This Machine Offers Features to Utilize The Full Potential of the Modern Rotating Carbide Gun Drill. ***Send for Free Illustrated Bulletin 2G***

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COMPLICATED PARTS EASILY-DRILLED WITH EDLUND GUN DRILLING MACHINES
.125" Diameter Holes—5½" Deep. Size within .003" Straightness within .002"

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EDLUND
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Every CARD tap is duplicated with geometric precision, in each type and size. This exact duplication brings valuable production benefits to every user. Make sure you get them by specifying CARD taps from your CARD Distributor. He has the taps, dies, gages and screw plates you need. For expert aid in selection and use, see your CARD technical man. S. W. CARD DIVISION, Mansfield, Mass. Card Warehouses: Atlanta, Chicago, Detroit, Fort Worth, Los Angeles, New York, San Francisco.

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DIVISION OF UNION TWIST DRILL COMPANY

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36C.0.3

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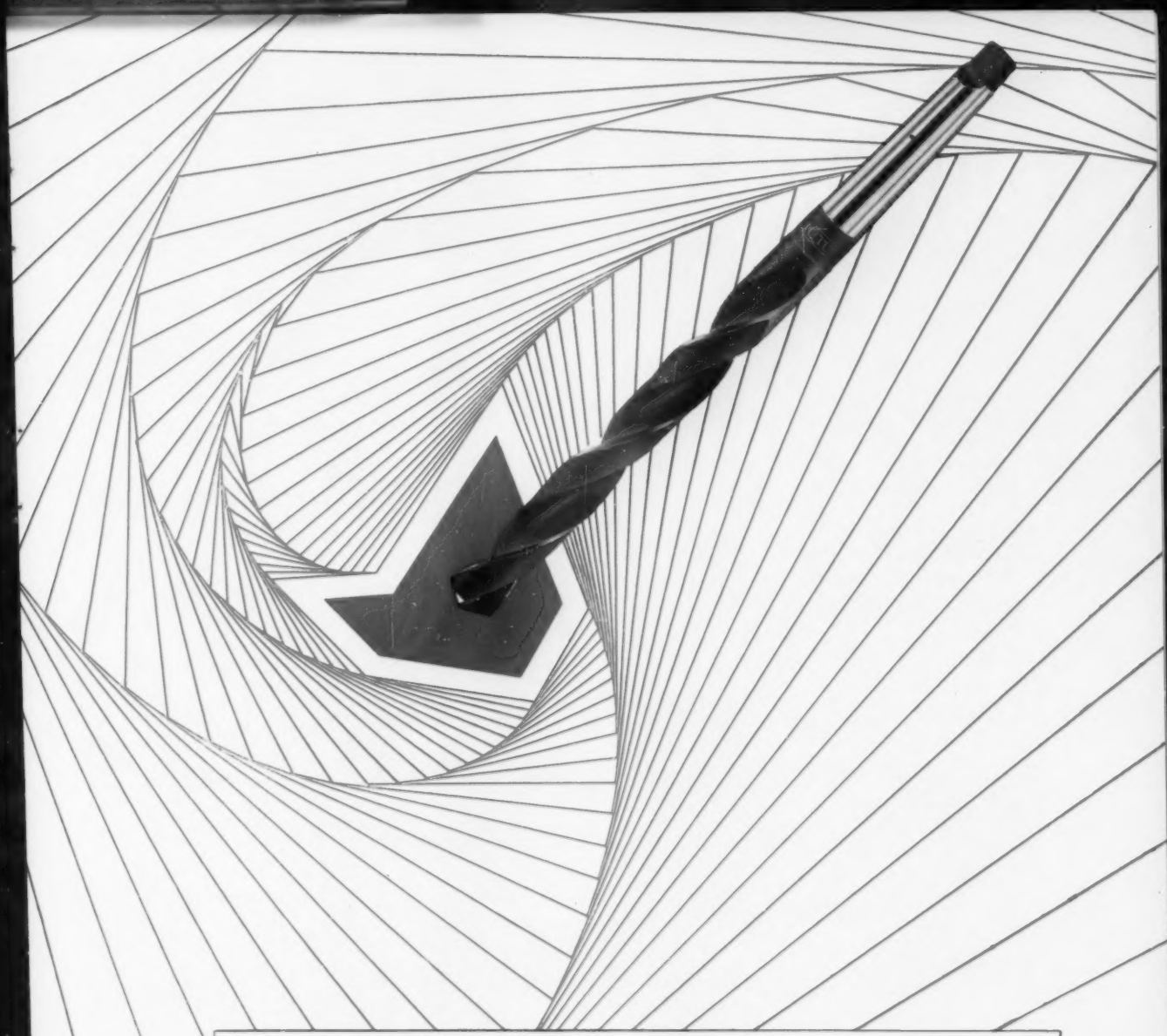

GEOMETRIC PROGRESSION SYMBOLIZES PRECISE DUPLICATION

CALCULATED TO CUT COSTS

A truly geometric pattern is followed in precisely duplicating each UNION cutting tool, according to type and size. In your plant exactly duplicated UNION drills will protect product quality and aid in reducing drill consumption. For high volume, high quality production, specify UNION drills, reamers, milling cutters, end mills, gear cutters, hobs, carbide tools, and inserted blade cutters. Available nationally through UNION Distributors and stocked in UNION warehouses in Atlanta, Chicago, Detroit, Fort Worth, Los Angeles, New York City, and San Francisco.

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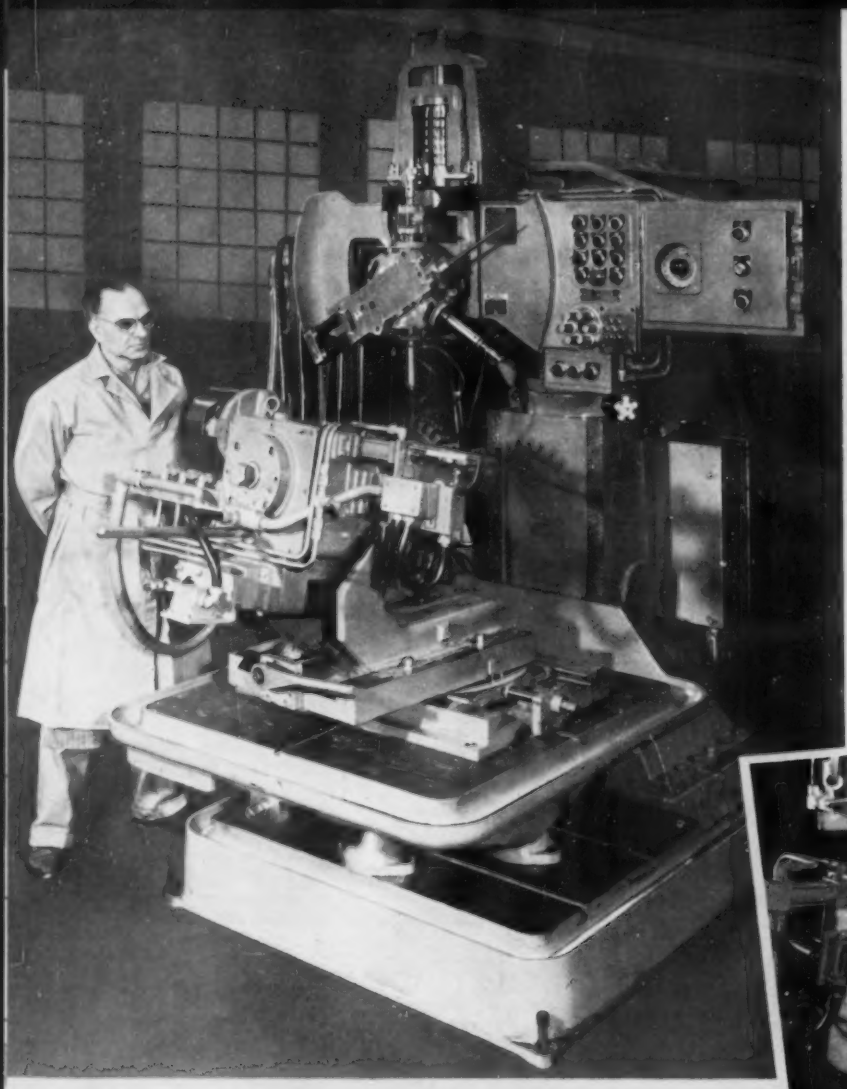
Machine Time Reduced 30%

BURGMASTER 2BR-H RADIAL



THE MACHINE TOOL

MMT-PE

Exposition - 1960

Ingersoll special Universal Fixture completely interlocked mechanically and electrically with the Burgmaster 2BR-H Radial Turret Drill for automatically performing 5 machining operations 30 times in this 14" diameter blade cutter body. Standard machine controls permits machine to be quickly set-up for handling a series of different cutters.

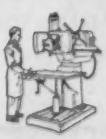
Burgmaster 2BR-H specially tooled by Ingersoll to process wedge screw holes in Ingersoll inserted-blade milling cutters. Machine time was reduced 30% and direct saving of 75% effected.

World's Largest Builder of Turret Drilling Machines

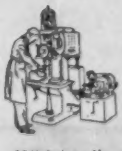
"O" Manual Power Index ¾" Capacity

1C Manual Power Index ⅞" Capacity

2B Manual Power Index ¾" Capacity

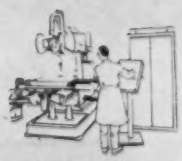


2BR Ram Type Radial Drill ¾" Capacity

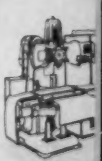


2BH Automatic Hydraulic ¾" Capacity

3BH Automatic Hydraulic 1½" Capacity



2SAH Automatic Tape Controlled 1¼" Capacity



2BHT-3BHT A Tape Contr ¾" and 1½"

....Direct Labor Savings 75%....

automatic hydraulic TURRET DRILL

(at the Ingersoll Milling Machine Co., Rockford, Illinois)

A Burgmaster 2BR-H Automatic Hydraulic, 6 Spindle Turret Drilling and Tapping Machine, with a special designed Ingersoll Automatic Universal Indexing Fixture for processing wedge screw holes in Ingersoll inserted-blade milling cutter bodies, reduces machine time 30% and effects direct savings of 75%, plus additional indirect savings. Formerly cutter body holes were machined on a plain radial drill press equipped with a single manually indexed fixture, and tools individually hand changed for the various operations.

The automatic indexing fixture, which is used for a variety of different cutter bodies, is completely interlocked mechanically and electrically with the machine cycle for continuous automatic machining—free from operator control. The machine automatically locates and relief drills accurately for each cutter slot, clamps the work piece while machining, drills, c'bores, inspects hole for depth, cleans out chips and taps. These operations are performed 30 times for this 14" diameter, 30 blade cutter. The operator only loads and unloads the machine and presses a start button.

FLEXIBLE AUTOMATION

All standard Burgmaster adjustable controls are retained in this model 2BR-H machine which permits fast set-up from one part to another. These include pre-selective spindle speeds, infinitely variable pre-selective feeds, selective rapid approach and return, skip indexing, precision depth control, and simple controls for set-up. The radial ram can be set and operated at any point through a 250° radial movement and from 14" minimum to 42" maximum extension. If desired, this machine can be equipped with a circular table and automatically controlled to permit the machining of a series of bolt circles or circular hole patterns. Special machines of this type, built up from standard components including tape controls, have also been supplied.

Regardless of your requirement, there is a Burgmaster Turret Drill that will do it faster, at less cost. Call our nearest dealer or representative. There is no obligation.

JOB FACTS

Machine:	Burgmaster 2BR-H, 6 Spindle, Automatic Hydraulic Radial Turret Drilling and Tapping Machine.
Company:	The Ingersoll Milling Machine Company, Rockford, Illinois.
Part:	Ingersoll Inserted-Blade Milling Cutter Body, 14" diameter with 30 Blades.
Holding:	Ingersoll specially designed, automatic indexing fixture with Universal adjusting features for various types of cutter bodies.
Material:	Steel.
Operations:	Automatically locates and relief drills accurately for each cutter slot, clamps cutter while machining, drills, c'bores, inspects hole for depth, cleans out chips and taps.
Former Method:	Plain Radial Drill equipped with a simple manually indexed fixture. Tools individually hand changed for various operations.
Savings:	...Machine time reduced 30% ...Direct savings in time 75% ...Misc. Indirect Savings — During automatic cycle the operator works at another station near the machine. ...Greater accuracy.

Write for bulletin describing Burgmaster 6 and 8 spindle Automatic Hydraulic Turret Drills and Radial 6 Spindle Turret Drills in detail. Thirty-minute 16mm sound film showing Burgmaster turret drills in operation including the new automatic positioning table, available from any office.

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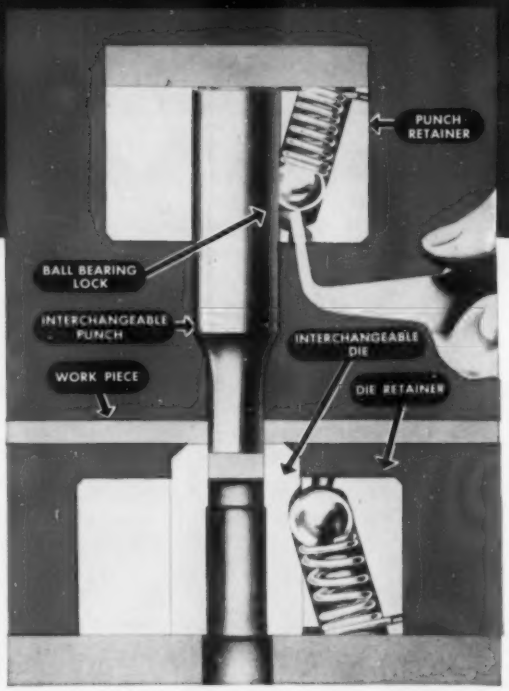
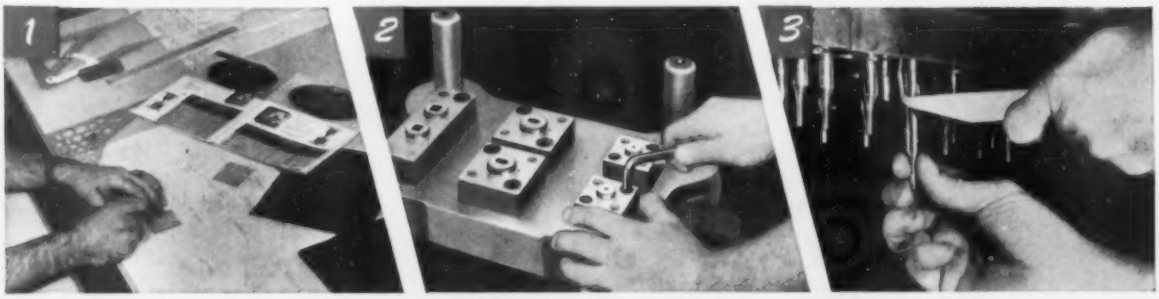
You Save Time and Cut Costs with R-B PUNCHES and DIES



How They Work . . .

R-B punches and die buttons are locked in standard or special retainers which are mounted on the die shoes. A spring-loaded ball lock produces positive radial alignment and vertical locking; *no additional keying is necessary regardless of the size or shape of the punch.* Up to ¾" stock can be pierced. R-B punches and dies are easy to insert; push and twist and they're locked. They're easily removed, too. Retainer holes provide for insertion of tanged tool which releases ball and allows instant removal of punch or die.

HOW THEY SAVE TIME AND CUT COSTS . . .



IN DIE DESIGNING

. . . you save "board time" by working with the standardized R-B concept of punches, die buttons, punch retainers and die button retainers. R-B standardized equipment reduces drafting time to cut your costs.

IN DIE CONSTRUCTION

. . . you save "building time" because R-B punches, die buttons, punch retainers and die button retainers are furnished completely finished. R-B saves skilled diemaker's time to cut your costs.

IN DIE OPERATION

. . . you save "press time" because R-B punches and die buttons are instantly removed and replacements quickly inserted. Inherent accurate alignment and positive locking keep press down-time at a minimum to cut your costs.

SEE US IN BOOTH 1814

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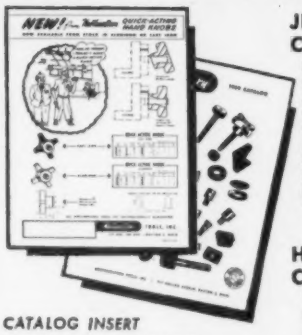
QUICK-ACTING HAND KNOBS



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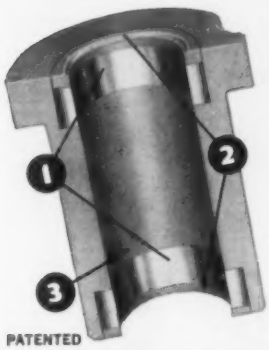

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1. Tungsten carbide rings at the points of wear; 2. Steel rings protect drills and carbide; 3. Special hardened alloy steel body.

There in a nut shell is the story of MEYCO carbide inserted drill jig bushings! Does everything a solid carbide bushing will do at less cost: lasts almost as long; increases life of drills and jigs; greater accuracy—longer; saves man-hours and machine down-time! All this spells high production at a lower cost. For over a decade, carbide inserted drill jig bushings have been saving money on long production runs for cost conscious customers.

Write for new Bushing Catalog No. 42

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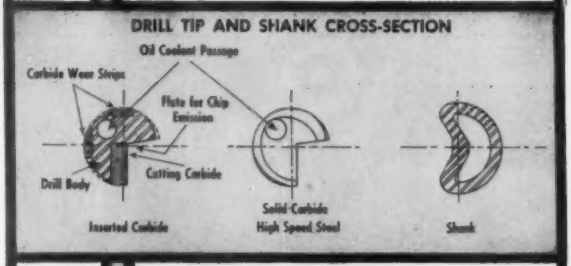
THIS DRILL ELIMINATES SECONDARY OPERATIONS

Just *one* pass with these high-speed steel or carbide-tipped gun drills produces an accurate, truly round, straight hole honed to mirror-bright finish. That's why you can drill small parts of all kinds — *faster, more accurately* and at *lower cost* with HI-STANDARD Gun Drills*.

Production parts that once had to be drilled individually can now be gang-nested and drilled through, producing holes identical in size, location and finish. Drilling of this kind is done on automatic indexing machines, lathes, horizontal and upright drilling machines, and similar equipment. Forced oil feed through the drill clears chips and cools cutting edge for faster drilling. No matter what the size or shape of your workpiece, drilling with HI-STANDARD Gun Drills is an



outstanding time-and-money saver. Any material that can be *machined*, can be *gun-drilled.*

Gun drilling is one important way in which forward-thinking manufacturers are increasing production and cutting costs. To find out how your company can do the same, write for your Hi-Standard Engineering File 20 *today!*

*Also called "deep-hole drills"

Pioneers in the Design and Development of Gun Drills for more than 30 Years

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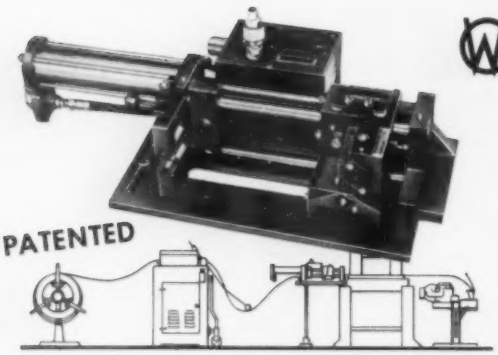

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The proven, low-cost way to get increased output and efficiency from your present stamping and shearing equipment. Ideal automatic operation even on short runs and frequent changeovers.

Simple, versatile, self-contained — operates from standard air lines — install directly on press bolster — simple air valve and cam timing — quick, accurate single-screw feed adjustment — open throat construction handles widest range of stock widths — nine sizes, with strokes to 24", for flat or irregular stock to 3/16" thick and 30" wide in lighter gauges.

FOR A FULLY AUTOMATIC STAMPING LINE

also ask about Cooper Weymouth combination cradles and straighteners, stock reels, stock and wire straighteners, scrap choppers and small parts straighteners.

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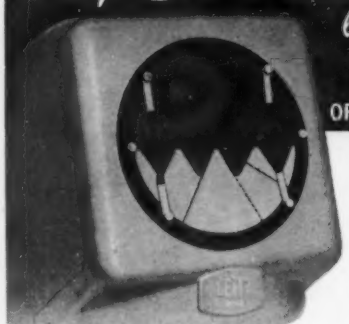
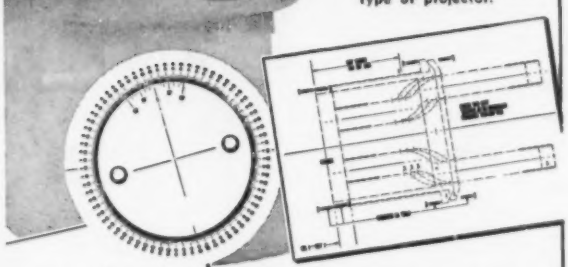


Comparator charts are available in a great variety of stock plastic templates for threads, radii, grid, angles, etc. at low cost.

Special charts can be developed from your blue prints to special specifications and at close limits to suit any type of projector.



Request Stock Chart Catalog No. 56 or submit prints for special proposal.

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Tool Steel Topics

BETHLEHEM STEEL COMPANY, BETHLEHEM, PA.

BETHLEHEM TOOL STEEL ENGINEER SAYS:

Bake Tools After Plating

There are three reasons why tools are electroplated with chromium or nickel: (1) salvage, by regaining worn dimensions, or correcting mechanical errors (2) decoration (3) to resist wear or metal pickup.

Although electroplating of hardened tools is relatively simple, it can be hazardous if the plating is not followed by baking (tempering). During deposition of the plated metal, a considerable amount of hydrogen also is deposited on the tool. Some of this hydrogen diffuses into the tool. This causes extreme brittleness, so that if the tool is used immediately after plating, breakage in service may occur.

To avoid such an occurrence, bake the tool at 300-400F for at least four hours, to restore its original ductility. Baking should begin as soon as possible after plating. Grinding should never be done on the steel itself prior to baking. If baking is omitted, the tool will gradually recover its ductility at room temperature in from two to three weeks. It will be subject to breakage if used before the recovery has been completed.

Inserts of Brake Die Tool Steel form runners for oven wrappers

The sheet-steel part above is an oven "wrapper" for a gas range, produced by Caloric Appliance Corp., Topton, Pa. The wrapper has deep side-member runners on opposite sides. These were formed by inserts of Bethlehem Brake Die in the tool steel forming die at the right of the photograph.

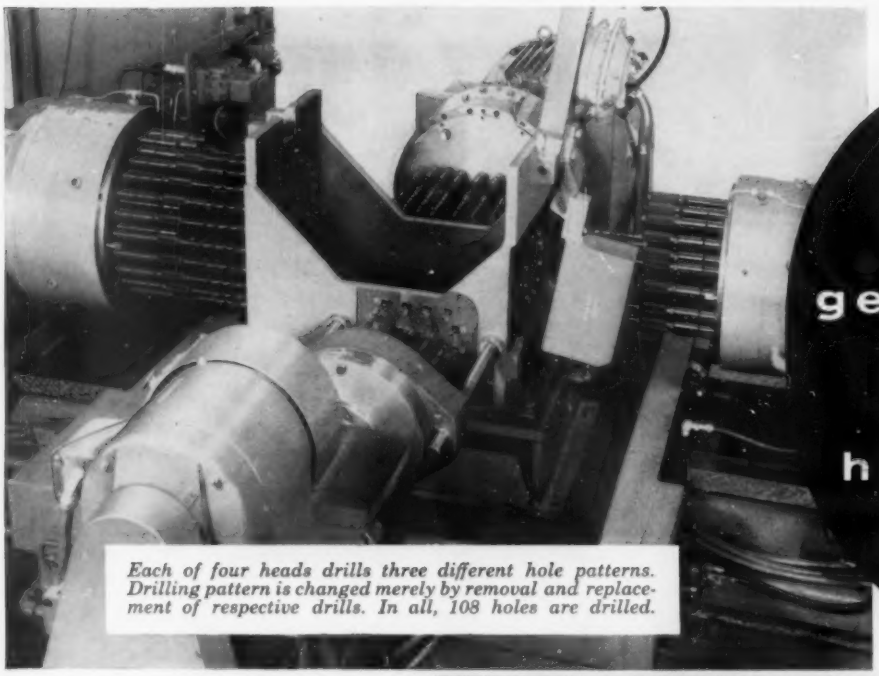
Caloric's engineers reported fine results with Brake Die because of its durability. It also proved economical, as it saved time during machining. Used in duplicate sets of three, the inserts formed 22-gage steel to the tune of some 4,000 pieces before polishing became necessary.

Bethlehem Brake Die is ideal for intricate bending and forming applications because of its fine wear resistance, high toughness, and exceptional resistance to impact. It saves money, because it comes in the heat-treated condition, ready for machining without further hardening. We not only quench and temper Brake Die to develop its superior properties—we also straighten it mechanically. This is followed by a stress-relief-anneal, then gag straightening.

Give Brake Die a trial. But don't baby it—choose a tough job. The nearest Bethlehem tool steel distributor will be pleased to work with you.

Because of its high vanadium content, Bethlehem Cromo-High V is ideal for die casting aluminum- and magnesium-base alloys in the 1200F-1300F range.

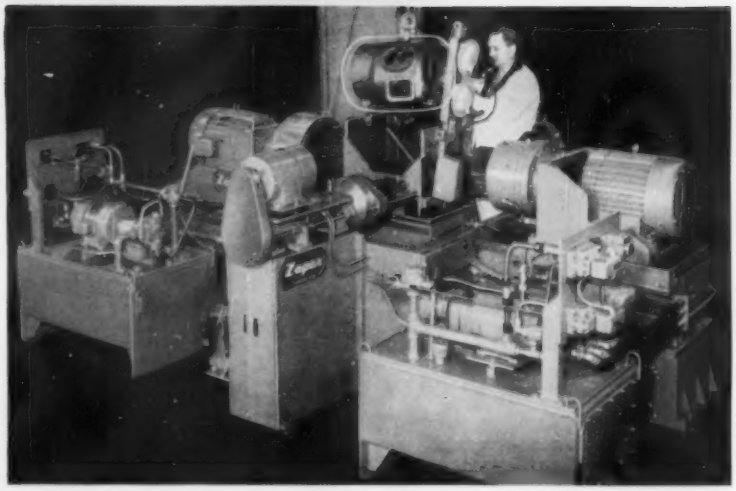
Cromo-High V has outstanding machinability because it comes in the annealed condition (Brinell 207). It has excellent resistance to the formation of a fine network pattern of heat checking. In heat-treatment, it develops the uniform hardness needed to resist wash and erosion.



Each of four heads drills three different hole patterns. Drilling pattern is changed merely by removal and replacement of respective drills. In all, 108 holes are drilled.

why gearless drill heads?

because Zagar *gearless design can use more spindles and do more work*



Zagar gearless design in multiple spindle machining permits a flexibility unmatched by any other equipment. Basically, the application of more and still more spindles is the key to savings in every stage of the job. From incipient engineering through cost per part (or cost per hole), every step is marked by cost-saving over any other approach. As spindles are added, cost per spindle actually decreases. This advantage obtains whether the head is designed to produce one part or more than one part of varying machining patterns.

When drilling, reaming and tapping on more than one part, Zagar can often apply one head to do several patterns. Zagar heads drill, ream, and tap varying diameters on any center.

See Three Zagar Exhibits at the A.S.T.E. Show: Booth 351, 718 and 1653

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USE MORE SPINDLES TO DO MORE WORK

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"NO SPOILAGE PERMITTED"

Because I.D. honing and other costly machining precedes internal tapping of outer jackets for hydraulic cylinders, Towmotor Corporation specified a Namco RST Collapsible Tap to insure "no spoilage" tapping. Supplied with a 5-chaser circular head and installed on existing turning equipment, the tap cuts perfect Class 2 threads . . . *on every piece;* meets Towmotor's rigid requirements with ease.

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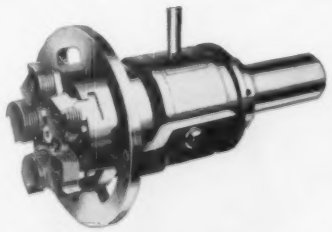

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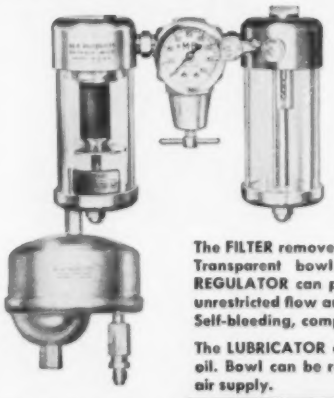

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Either the impact mechanism "pack" or the motor "pack" can be serviced individually without disturbing the other.

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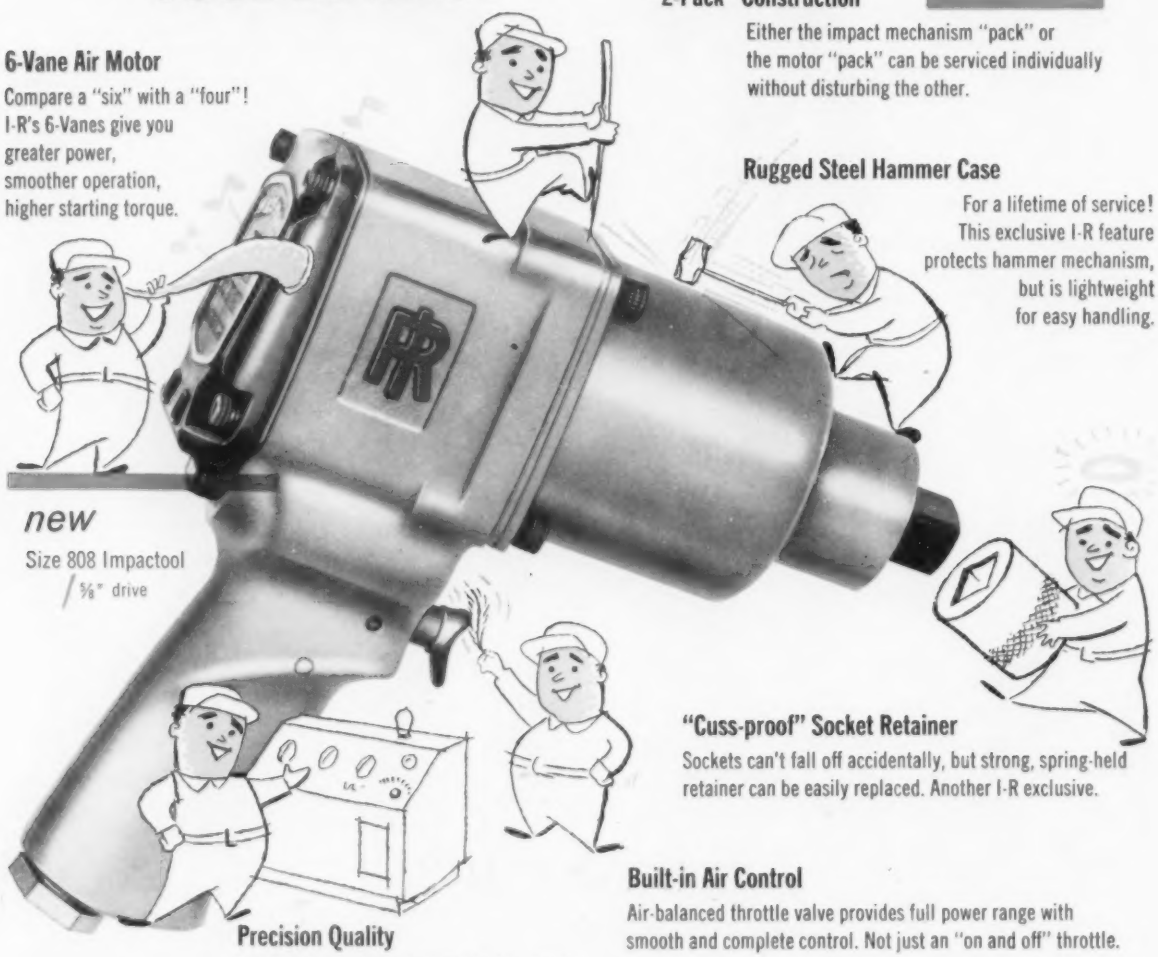
For a lifetime of service! This exclusive I-R feature protects hammer mechanism, but is lightweight for easy handling.



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Size 808 Impactool

⅜" drive

"Cuss-proof" Socket Retainer

Sockets can't fall off accidentally, but strong, spring-held retainer can be easily replaced. Another I-R exclusive.

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Air-balanced throttle valve provides full power range with smooth and complete control. Not just an "on and off" throttle.

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Special electronic equipment double-checks machined parts for perfect mating of all surfaces and bores.

LOOK FOR I-R EXTRAS BEFORE YOU BUY!

Smart buyers and experienced tool men know these Ingersoll-Rand EXTRAS pay off . . . in terms of longer tool life, easier maintenance, and better nut running performance. With them you get 20% more power and 200% faster rundown in a precision tool so small (7½") and light (8⅞ lbs.) you can use it anywhere.

For details on the all-new Size 808 Impactool, call your I-R representative today. Or write: Ingersoll-Rand, 11 Broadway, New York 4, N. Y.

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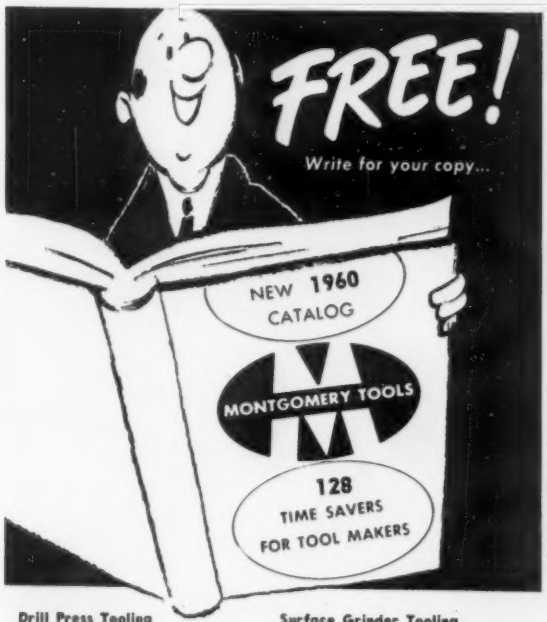

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1	Stainless Steel Ball and Race	For types operating under high temperature (800-1200 degrees F.).
2	Chrome Alloy Steel Ball and Race	For types operating under high radial ultimate loads (3000-893,000 lbs.).
3	Bronze Race and Chrome Steel Ball	For types operating under normal loads with minimum friction requirements.

Thousands in use. Backed by years of service life. Wide variety of Plain Types in bore sizes 3/16" to 6" Dia. Rod end types in similar size range with externally or internally threaded shanks. Our Engineers welcome an opportunity of studying individual requirements and prescribing a type or types which will serve under your demanding conditions. Southwest can design special types to fit individual specifications. As a result of thorough study of different operating conditions, various steel alloys have been used to meet specific needs. Write for Engineering Manual No. 551. Address Dept. TE60

SOUTHWEST PRODUCTS CO.
1705 SO. MOUNTAIN AVE., MONROVIA, CALIFORNIA

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Gilman PRECISION SLIDE ASSEMBLIES

...available FROM STOCK in 132 standard types and sizes

LIGHT DUTY BASIC TYPE

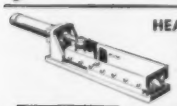
HEAVY DUTY BASIC TYPE

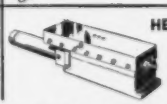
LIGHT DUTY TYPE WITH RETURN SPRING

HEAVY DUTY MICROMETER STOP TYPE

LIGHT DUTY LEAD SCREW TYPE

HEAVY DUTY LEAD SCREW TYPE


HEAVY DUTY CYLINDER POWERED (in-line mount)


HEAVY DUTY CYLINDER POWERED (lower mount)

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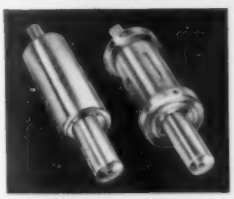

(Left) plain type. (Right) with longitudinal positioning nuts. Both are shown with BLANK SPINDLE END for machining by user.

Gilman CARTRIDGE-TYPE SPINDLE ASSEMBLIES

... available from stock in 28 standard types and sizes

AVAILABLE in plain cylindrical type or with longitudinal positioning nuts. Five types of spindle noses are offered. Range of cartridge diameters from 1.250" to 2.750".

Design Advantages

- Steel spindles are precision machined and ground, with close tolerances maintained throughout.
- Matched, double-row ball bearings at tool end of spindle . . . single-row ball bearings at the driven end.
- Positioning nuts are graduated in increments of spindle adjustment of 0.001".
- Spindle assemblies can be mounted in a bored hole or in Gilman precision mounting brackets.

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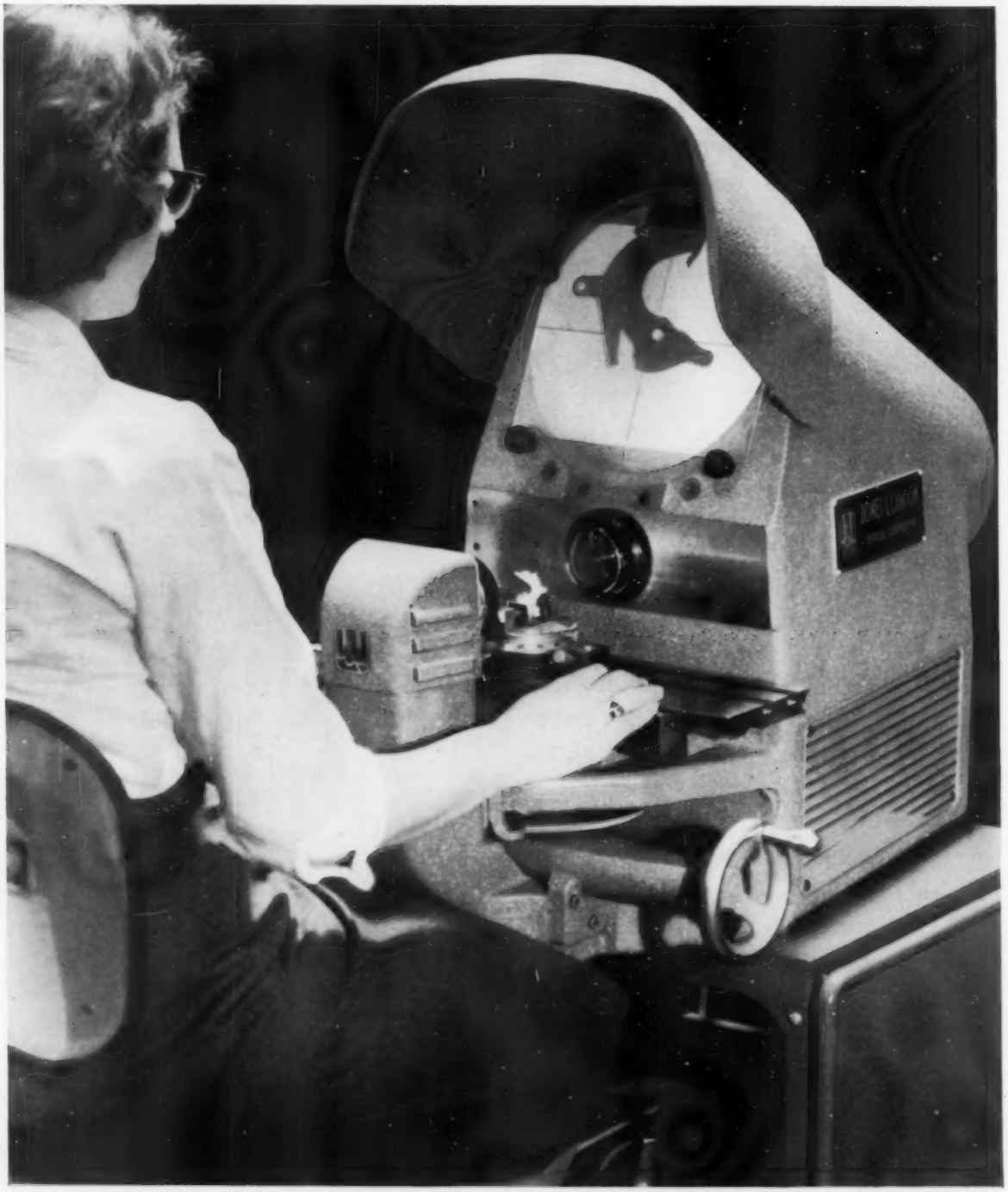
NOW...an ECONOMY-SIZE with "Big Machine" Features



J & L's new 10" screen model as used in the horizontal position.

OPTICAL COMPARATOR ...the new J&L TC-10

Now, for the first time, the most important features of "big" optical comparators have been combined in a relatively inexpensive machine, the J&L TC-10. As a result, medium and small producers can greatly improve their quality control procedures.

Three different table styles are available, including a fixed table for straight comparison work, a plain table, and a measuring table which gives 3 inches horizontal measurement and 2 inches vertical. All measurements are read directly to .0001", without computation.

The TC-10 handles big 8 x 10" overlay charts and provides precise comparison inspection for a high percentage of most jobs that are normally handled on larger machines. Eccentric chart holders afford rapid alignment of overlay charts in either the horizontal or vertical position.

Other "big machine" features:

ANGLE MEASURING is accomplished with a chart graduated in 90° segments around the full 360° of its periphery, providing direct measurements to 5 minutes of angle.

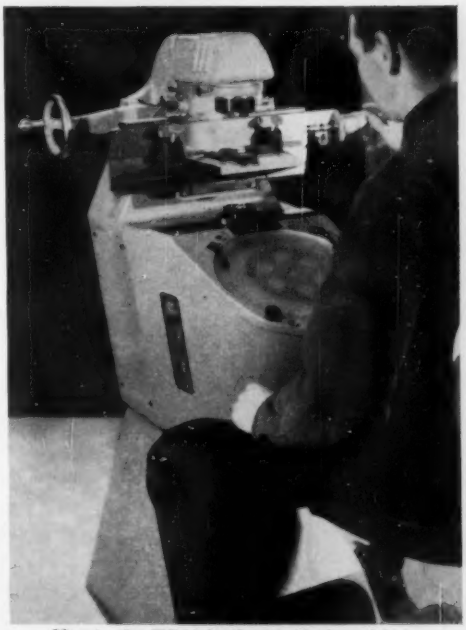
QUICK-CHANGE LENS MOUNT accommodates all lenses from 5X to 125X, with no lens or mirror adjustments necessary. Lenses are matched, pre-set, pre-focused, and coated for extra light transmission.

VERTICAL STAGING is done easily. A custom-designed metal stand rigidly supports the machine in the vertical position. Staging facilities include 2 x 3" coordinate measurements, read directly to .0001", and a plain vertical stage with travel in one direction for straight comparison work.

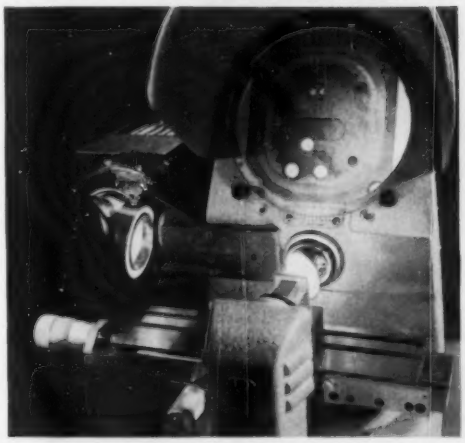
TRACING INSPECTION facilities are readily available. A standard J & L tracing fixture is easily mounted beside the lens.

BONUS! The new 5X, 2" aperture lens, specially designed for the machine, provides comparison inspection capacity and accuracy never before offered on a machine of this size.

See the TC-10 in operation at Booth #1208 ASTE Show, or write for folder #GL-6000.



Here's the TC-10 in the vertical position.



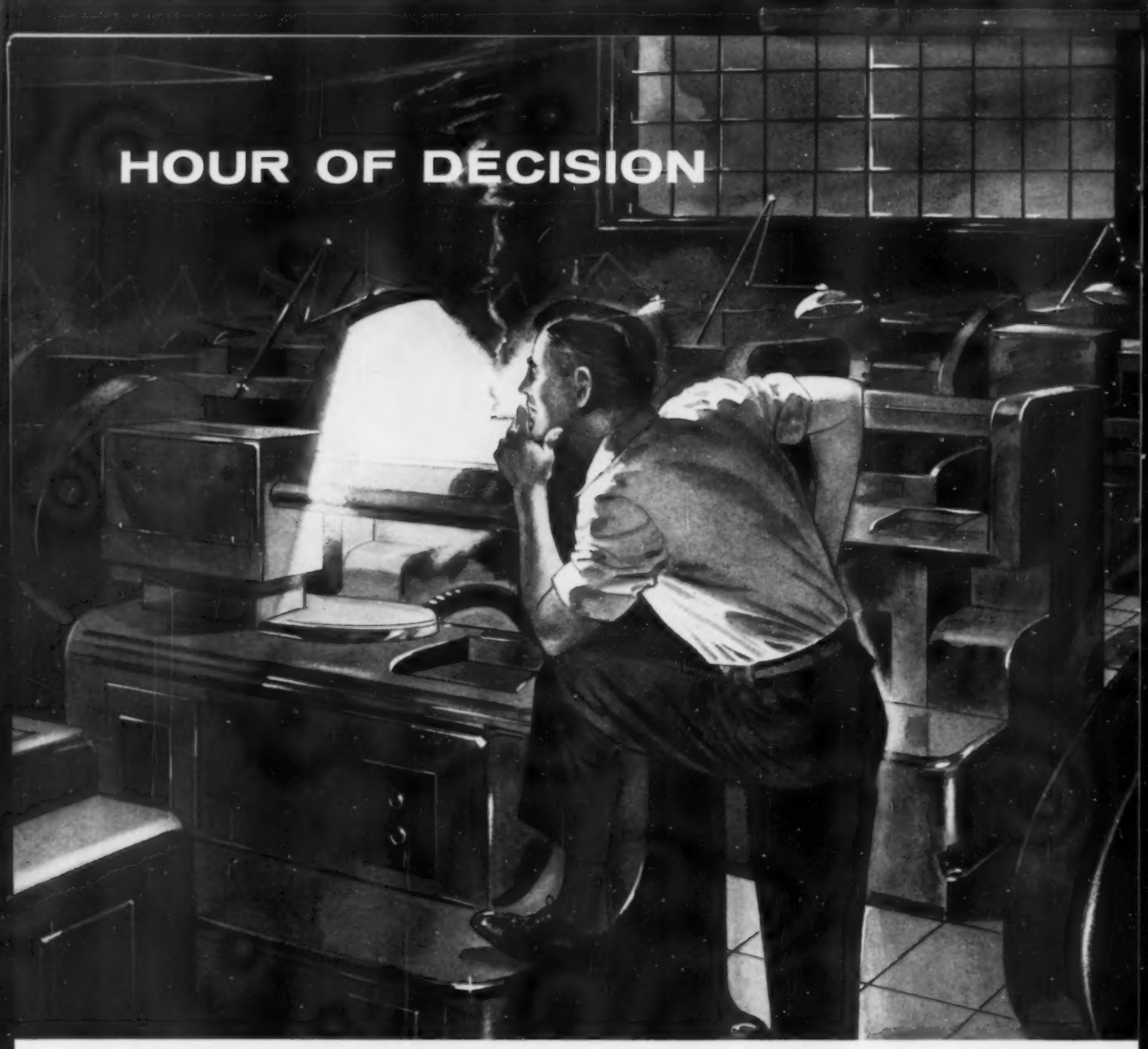
REFLECTION Inspection, too! Among other things, the TC-10 is adaptable for *reflection inspection*. Reflected images are extremely sharp – even at high magnifications.

"the world's oldest and largest maker of optical comparators"

JONES & LAMSON

COMPARATOR DIVISION

JONES & LAMSON MACHINE COMPANY, 518 Clinton Street, Springfield, Vermont



IS THIS YOU? How many times, after the call bell stops clanging, the customers stop phoning, and people stop asking questions, do you walk into the quiet shop to face up to the really vital decisions?

"How can we compensate for the rising costs of materials, overhead, payroll, maintenance?" "How can we keep producing the exacting tolerances, finishes, and quality our markets are demanding?" "How can we improve our production efficiency so that our narrow profit margin will not disappear altogether?" "How can we meet and beat the increasing world-wide competition in our field?"

One proved answer to these questions is the logical replacement of obsolete, inefficient machines. THE MACHINE TOOL EXPOSITION — 1960 will back up this fact with 11 acres of the latest developments in machine tools. Can you afford to miss seeing new, faster machine tools that will produce more efficiently . . . new, better methods that will cut satisfying chunks out of metalworking costs . . . new, ingenious ideas that will help you produce more quality for less cost?

Tool-up for the Sixties. Plan *now* to attend the largest, single-industry exposition ever held in the United States. Have your key personnel on hand, too. It's a once in five years chance to examine the latest technological advancements in automation through numerical controls and see why Modern Machine Tools = Production Efficiency!

Also see the PRODUCTION ENGINEERING SHOW on the Navy Pier. One registration covers both.

FORMULA FOR TOMORROW

MODERN MACHINE TOOLS = PRODUCTION EFFICIENCY

MMT=PE

International Amphitheatre
Chicago, Illinois
Sept. 6-16

THE MACHINE TOOL EXPOSITION — 1960

For information write to

NATIONAL MACHINE TOOL BUILDERS ASSOCIATION

2139 Wisconsin Avenue, N.W. • Washington, D. C.

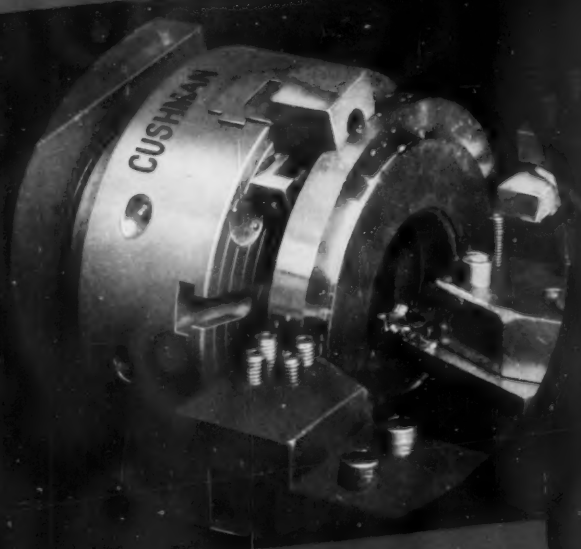
BULLETIN NO. PO-66D

CUSHMAN

George - This looks like the answer to our problem. Have their rep. come in.
HRS.

air operated CHUCKING EQUIPMENT

'60
BOOTH 1021



- INCREASES PRODUCTION
- LOWERS COSTS
- REDUCES FATIGUE
- IMPROVES QUALITY
- DECREASES FLOOR-TO-FLOOR TIME

THE CUSHMAN CHUCK COMPANY • HARTFORD 2, CONNECTICUT

COLD-HEAD THESE AT *450* PER MINUTE

National High Speed Headers are capable of producing a wide variety of odd shapes like the above, as well as conventional fastener blanks.

Screw blanks stand perfectly erect. Such accuracy of product begins with a square, clean cutoff blank.

If you operate Headers, or use metal parts in quantity, here is good news.

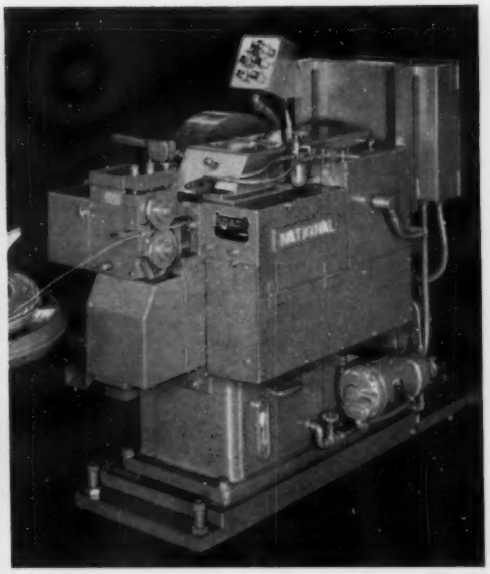
The National High Speed Cold Header is the exciting new breakthrough in producing metal parts!

Witness production runs of difficult-to-make parts. Observe the many advanced features in machines and tooling, as well as new cold-heading techniques now proved in everyday production.

Start now toward the benefits of sustained production at the highest *safe* speeds ever achieved. Be among the forward-looking header plants installing Nationals these days.

We offer you (1) A precision, hand-crafted machine, (2) Sound engineering assistance, and (3) Our experience in helping you flow metal.

ON NATIONAL 1/8" HIGH SPEED HEADERS!



1/8" High Speed Double Stroke
Solid Die Cold Header: 450
accurate pieces per minute

3/16" High Speed Double-Stroke
Solid-Die Cold Header:
350 accurate pieces per minute

Not just speed alone, but speed *plus...*

- Accuracy of Product
- Rigidity—Good Tool Life
- Holds Adjustment Well
- Lower Maintenance
- Fewer and Simple Adjustments
- Can Handle Many Jobs

We welcome you to Tiffin for actual demonstrations and a thorough study of your cold heading requirements.

Founded 1874—DESIGNERS and BUILDERS of MODERN FORGING MACHINES • MAXIPRESSES • REDUCEROLLS • COLD HEADERS BOLTMAKERS • NUT FORMERS • TAPPERS • NAILMAKERS CO-PIONEERS WITH INDUSTRY OF ADVANCED METALWORKING PRODUCTION METHODS

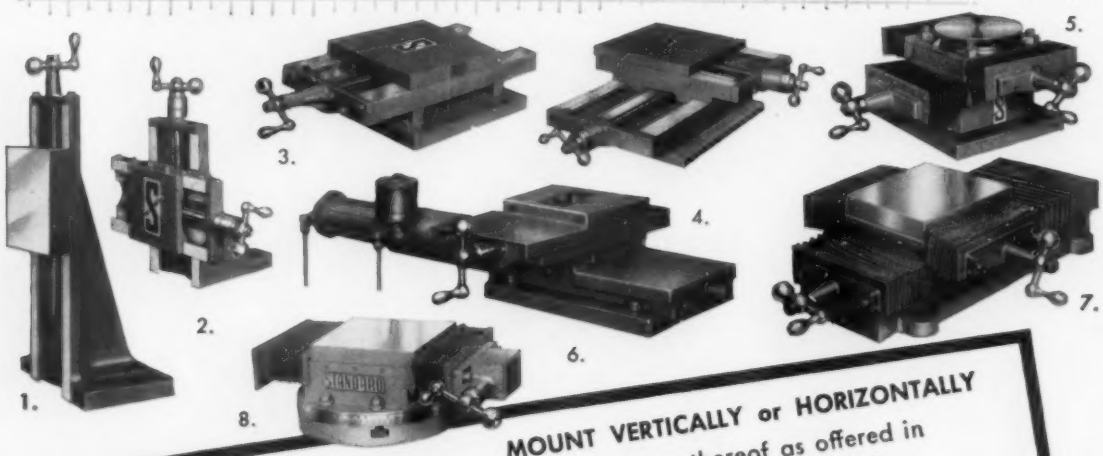
NATIONAL MACHINERY CO.

TIFFIN, OHIO, U. S. A.

HARTFORD DETROIT CHICAGO

AUTOMATION = Rotation (Spindles) / Movements (Feeds-Swivels) by STANDARD

BUILDING BLOCK



. . . just a few of the SLIDES-FEEDS-SWIVELS or Combinatons thereof as offered in STANDARD's **New Catalog** No. 22 . . . ask for **your** Copy.

MOUNT VERTICALLY or HORIZONTALLY

ANGLE PLATE MOUNTING: Fig. 1 with Vertical Feed. Fig. 2 with Vertical and Horizontal Feed.

BASE MOUNTING: Fig. 3 with Horizontal Feed. Figs. 4, 5, 6 and 7 with Compound Feeds.

AVAILABLE ON ANY FEED: Power Cylinders (Figs. 6. 10 and 11); Accordion Protectors (Figs. 5, 7 and 8); Right Angle Feeds (Figs. 8 and 9); 360° Swivel Work Base (Fig. 5); 360° Mounting Base (Figs. 8, 9, 11, 12 and 13).

Use
SLIDES-FEEDS-SWIVELS for SPINDLES-WORK-FIXTURES ALIGNMENT INSTRUMENTS etc.

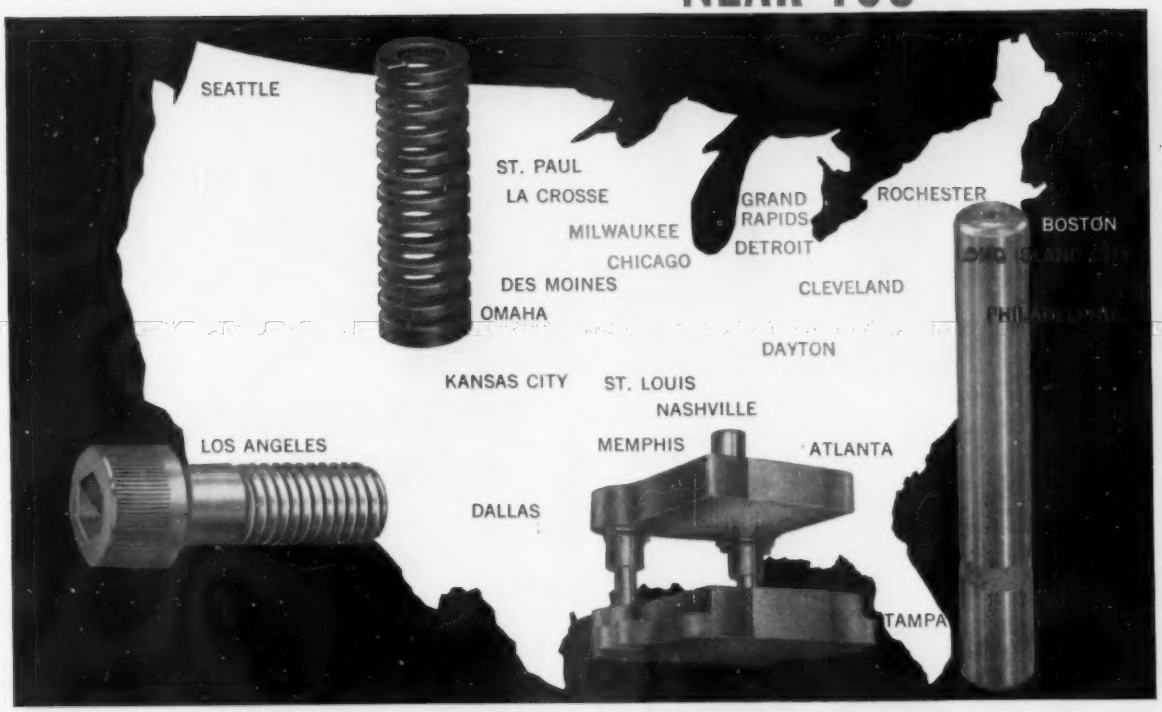
"BUILDING-BLOCK" ASSEMBLIES with STANDARD Feeds and Swivels and STANDARD Super Precision Spindles

ASTE SHOW
Detroit
April 21 to 28
Booth 1430

the STANDARD electrical tool co.

PRECISION SPINDLE AND MACHINE TOOL DIVISION
2499 RIVER RD. • CINCINNATI 4, OHIO

THERE'S A DANLY SUPPLIER NEAR YOU



For fast service on a full line of highest quality diemakers' supplies, call on Danly. A check of the following list will show there's a supplier located conveniently close by:

CALIFORNIA, Los Angeles 54
Ducommun Metals & Supply Co.
4890 South Alameda

FLORIDA, Tampa 5
Ellis-Erwin Supply Co., Inc.
120 N. 20th St.
P. O. Box 1465

GEORGIA, Atlanta
Bolden Die Supply Company
1171 Lee St., S. W.

ILLINOIS, Chicago 50
Danly Machine Specialties, Inc.
2100 S. Laramie Avenue

IOWA, Des Moines 2
Johnson Tool & Supply, Inc.
1537 Second Ave.
P. O. Box 368

MASSACHUSETTS, Boston 15
Chandler & Farquhar Company
900 Commonwealth Ave.

MICHIGAN, Detroit 16
Danly Machine Specialties, Inc.
1549 Temple Avenue

MICHIGAN, Grand Rapids
Danly Machine Specialties, Inc.
113 Michigan Street, N. W.

MINNESOTA, St. Paul
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33 Rutter Street

OHIO, Cleveland 30
Danly Machine Specialties, Inc.
11400 Brookpark Road

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Danly Machine Specialties, Inc.
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Danly Machine Specialties, Inc.
511 W. Courtland Street

TENNESSEE, Memphis
J. E. Dilworth Company
730 South Third Street

TENNESSEE, Nashville 7
Cumberland Die Supply Co., Inc.
1000 Mile End Ave.

TEXAS, Dallas
Briggs-Weaver Machinery Co.
5000 Hines Blvd.

WASHINGTON, Seattle 4
Hallidie Machinery Co., Inc.
210 Hudson St.

WISCONSIN, LaCrosse
Randall-Graw Co., Inc.
1007 Monitor St.

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Danly Machine Specialties, Inc.
807 S. 14th Street

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DANLY MACHINE SPECIALTIES, INC., 2100 S. LARAMIE AVE., CHICAGO 50, ILLINOIS

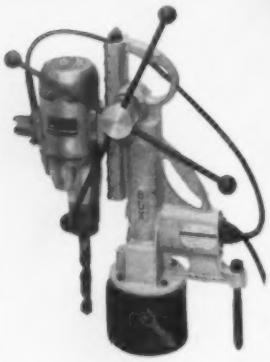
VISIT OUR BOOTH

DETROIT '60 APRIL 21-28

ASTE TOOL SHOW

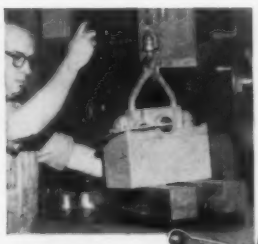
BUX 2242

NEW! BUX RADIAL POSITIONER

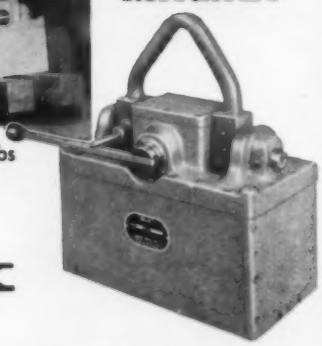


Accurate Drill Positioning— FAST!

New, positive mechanical-action Bux radial positioner assures faster, accurate alignment of Bux portable magnetic drill presses. Magnetic base remains stationary, safely holding unit to work on any *overhead* or *vertical* flat working surface. Full 330° positioning rotation. Lateral movement provided assures precision positioning for drilling, reaming, tapping. Available on Bux magnetic drill press models L-2RP and L-3RP.



LIFTING MAGNET



Cap. 3000 + lbs

by BUX

FEATURES:

- Absolutely Permanent Ceramic Magnets
- Lifts better than 3000 lbs
- 6½" x 13" lifting face
- Needs no wires (electric)
- Never needs "recharging"
- Magnet cannot be turned off when in use.
- No wet batteries or acid

BUX magnetic products

A Subsidiary of O. S. Walker Co.

BUCK MFG. CO.
P.O. Box 692
1355 North 10th St.
San Jose, Cal.

VISIT OUR BOOTH

DETROIT '60 APRIL 21-28

ASTE TOOL SHOW

Walker 2242

AT THE SHOW-

NEW!

CERAMAX ROTARY CHUCK

with Ceramic Magnets for Turning and Grinding

New Ceramax Rotary chucks with permanent ceramic magnets are powerful enough for safe rugged lathe work as well as grinding. All *steel* top plate construction. Variable holding for easy work positioning. Simplified spindle mounting has no collector rings or brush units. In the locked ON position, chuck will *not* demagnetize. Rotationally balanced whether in "ON" or "FREE" position. Available in sizes from 4" to 12" diameters.

O. S. Walker

O. S. WALKER CO. INC., WORCESTER, MASS.

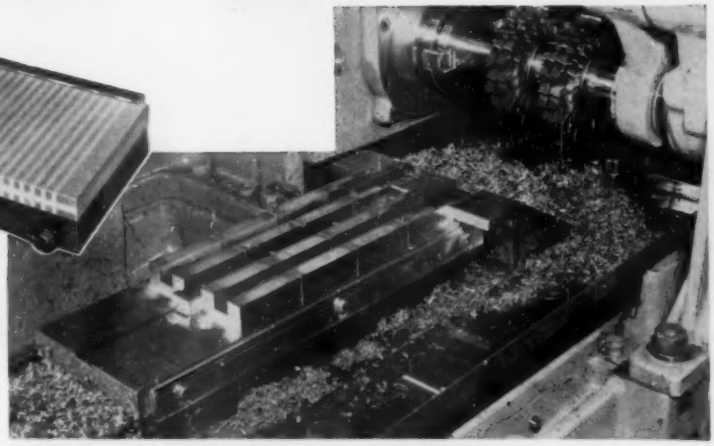
Original Designers & Builders of Magnetic Chucks

VISIT OUR BOOTH DETROIT '60 APRIL 21-28 ASTE TOOL SHOW

Walker 2242

VISIT OUR BOOTH DETROIT '60 APRIL 21-28 ASTE TOOL SHOW

Walker 2242



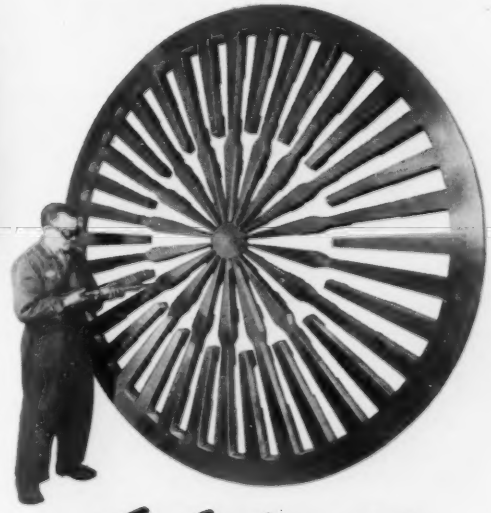
Walker CERAMAX RECTANGULAR CHUCKS

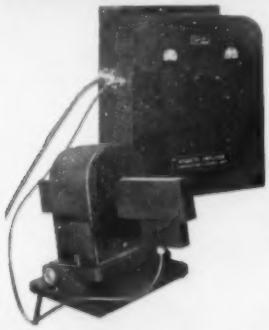
Check these advantages of Ceramax Chucks —

- Holding power extends to periphery of chuck.
- Silver brazed all-steel top plate.
- No magnetism imparted to work; chips and grit fall freely from work surface.
- No soft gap strips in which chips become imbedded — eliminates constant redressing.
- Three times coercive force of ordinary Alnico magnets.
- ¼" pole spacing.
- Low in height for greater machine capacity.
- Sizes from 4" x 4" to 12" x 24".

NO MATTER HOW COMPLEX YOUR PROBLEM

Walker has the know-how to solve it!





Here are three typical instances of how O. S. Walker, can solve unusual problems for customers.

Above — A large three faced electro magnetic chuck measuring 13½" x 22" x 158" especially built for the knife grinding industry.

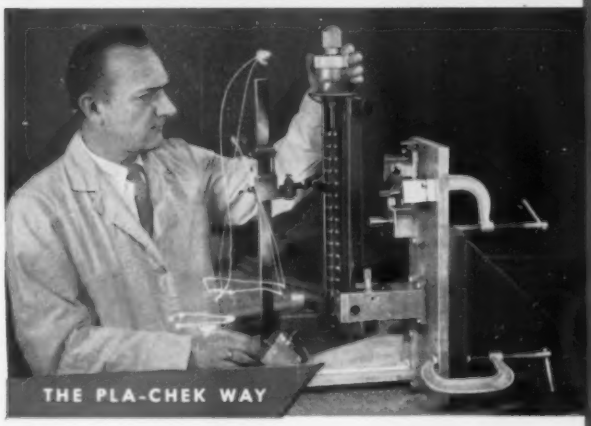
At right — A 96" diameter rotary auxiliary plate being prepared for production.

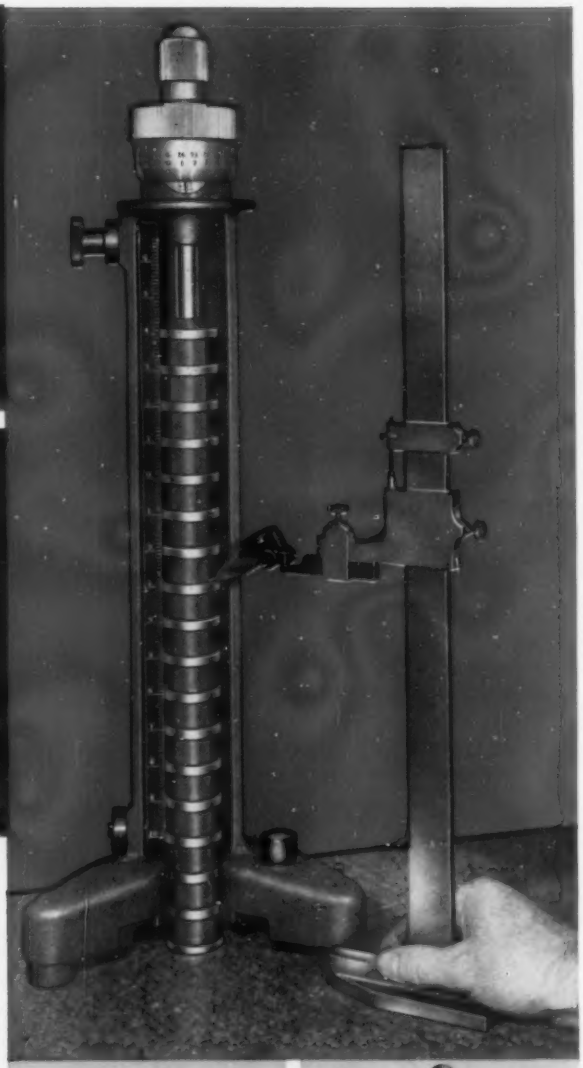
Above — An example of Walker engineered demagnetization — a special Saturable Reactor Control Demagnetizer for ball bearings.

O. S. Walker

O. S. WALKER CO. INC., WORCESTER, MASS.

Original Designers & Builders of Magnetic Chucks





See How PLA-CHEK Cuts Inspections from Minutes to Seconds

Notice the wrist light photos above. Just a turn of the Micrometer thimble and PLA-CHEK is set. Far fewer motions, far less time . . . and guaranteed accuracy to .00005″ throughout this PLA-CHEK'S entire range. No gage blocks or reference surfaces to touch—body heat can't affect it. Setting time 10 seconds . . . inspections in 1/5 the time of older methods. That speed and accuracy is being proved daily in thousands of installations throughout industry.

There are many other time-saving and money-saving features of PLA-CHEK Gages. Let us tell you about them. Write for complete, detailed literature.

COMPLETE RANGE OF SIZES

PLA-CHEK Gages are available in a full range of sizes to meet every inspection or surface plate layout requirement. Models are: The easily portable 6″ and 12″ sizes and the 18″ size (shown above) are guaranteed accurate to .00005″ throughout their entire range, and the 24″, the 36″ and the 48″ sizes are guaranteed accurate to .0001″ in any 24″ length or .0002″ over their entire range.

PRECISION RISERS

Built with the same precision as the gages themselves, PLA-CHEK Gage Risers may be used to extend the usefulness of every PLA-CHEK Gage from the smallest to the largest size. Available in 6″ height for 6″, 12″, 18″ PLA-CHEKS . . . 12″ height for 24″, 36″, 48″ models.

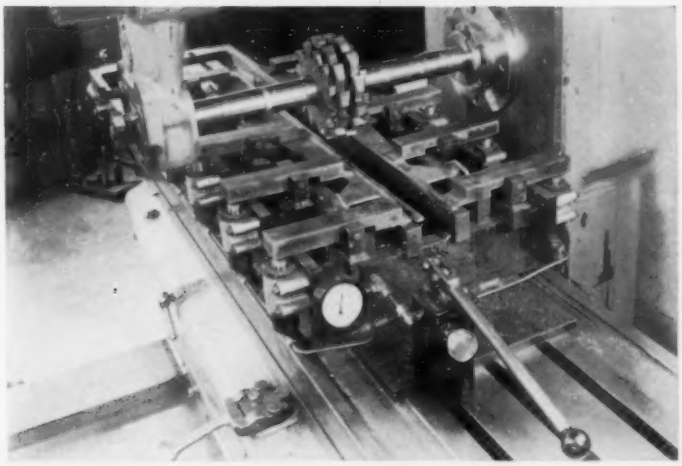
MICROMETER THIMBLE

Is graduated to .0001″ and provides dimensions between 1″ steps on measuring bar. Measuring bar of the 18″ model (as illustrated) and larger models, can be adjusted to enable the user to take readings up or down relative to a center line or other reference line on the work.

Cadillac GAGE COMPANY

P.O. BOX 3806 • DETROIT 5, MICHIGAN

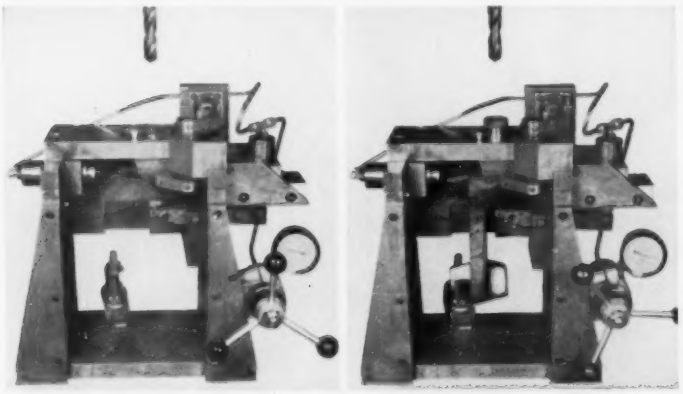
How other shops clamp down on loading time...



TRIANGLE PACKAGE BOOSTS PRODUCTION 335% . . .

reports Michael Zolnierczyk, Triangle Tooling Supervisor. Former floor-to-floor time, using mechanical clamping, averaged 57 minutes per piece or over 142 hours per 75 pairs. With Newton Hydraulic System, average floor-to-floor time has been cut to 17 minutes per piece, or 42 hours per 75 pairs, including set-up time. "The above figures," states Mr. Zolnierczyk, "represent a saving of 40 minutes per piece part, which is a production gain of 335%." Photo above shows Newton Hydraulic Tooling System installation machining fragile guide rails for conveyor system of meat packaging machine.

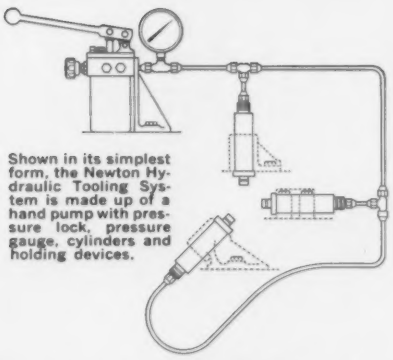
(The Triangle Package Machinery Company, Chicago, Illinois, manufactures filling, packaging and wrapping machines of particular importance to the food industry.)



R & H MACHINE SERVICE CLAMPS ODD-SHAPED PARTS RAPIDLY . . .

according to Robert Miller, Chief Engineer, who says: "The new Newton Hydraulic Clamping System is readily applied to a drilling jig for an odd-shaped casting, which would be awkward to clamp by other methods. Shown above are views before and after the part is positioned for drilling." Adds Mr. Miller, "Clamping and unclamping are far more rapid than would be possible with manual clamps. Pressure is uniform regardless of small variations in the size of castings or parts. Economy is another advantage. All the units, with the possible exception of some of the piping, can be used over again on other jigs and fixtures."

(R & H Machine Service, Cincinnati, Ohio are special machinery and tool builders.)



Shown in its simplest form, the Newton Hydraulic Tooling System is made up of a hand pump with pressure lock, pressure gauge, cylinders and holding devices.

Newton Hydraulic Clamping can speed up your production, too . . . . .

Newton System permits rapid operation of clamps in jigs and fixtures in a matter of seconds compared with the minutes lost by mechanical clamping. System consists of actuating pump feeding a number of clamping cylinders with hydraulic fluid under pressure. Extremely versatile, any number of cylinders usable up to pump's capacity. Various clamping positions facilitated. Pre-determined line pressures up to 2500 psi, are rigidly controlled. System provides easy, safe operation in confined work areas. Entirely self-contained unit. Screw or lever pumps, equipped with pressure locks, available in 2 sizes. Cylinders in varied size ranges. Hydropneumatic intensifiers also available for utmost clamping speed.

HYDRAULIC SYSTEM ASSURES:

- **Maximum reduction in clamping time**
- **Multiplicity of clamping positions**
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- **Controlled clamping pressures**
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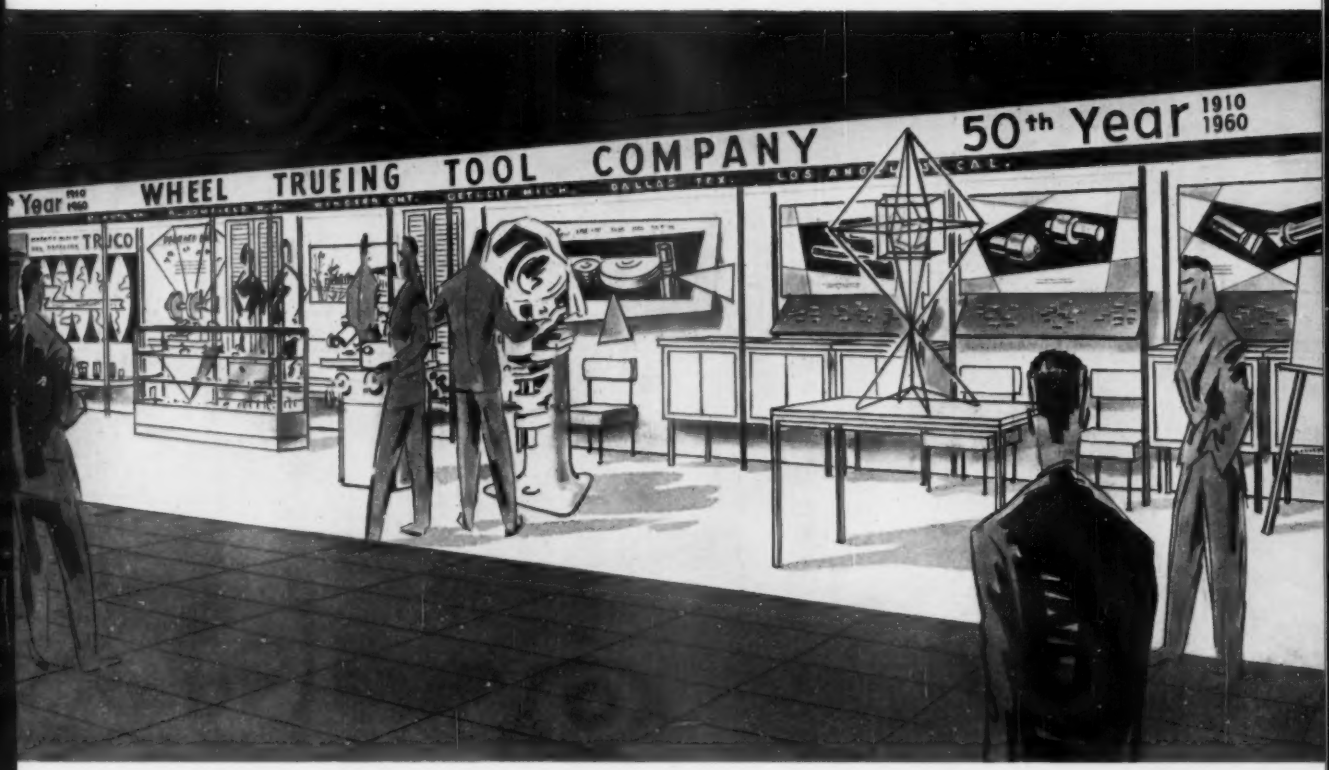


See us at Booth 338, ASTME Show, April 21-28

Practically every diamond tool in use today owes something to the fact that fifty years ago, some foresighted men started one of America's first diamond tool plants in a little home garage in Highland Park, Michigan.

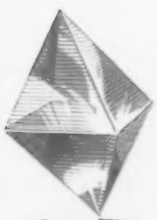
The diamond tool of those days was a primitive thing—a diamond in a metal shank stuck into a handle. Performance was unpredictable; wastage and diamond loss great.

But, these men had come up through the abrasive wheel business and were convinced that, since abrasive wheels differed so much—in size, bond, type and size of grain, hardness, etc., it was only logical that diamond dressing tools should be different, too; in fact, the ideal tool would be *engineered to match the specific wheel and its work.* They even believed that such tools could be *guaranteed* to do their intended job.

It was a radical idea for those days; it meant endless research on factory production lines and in laboratories but, it worked. A steady progression of new ideas in diamond tools, new concepts of application and performance flowed from the garage workshop and from the plants that succeeded it, changed diamond-using habits and established an American diamond industry that is unsurpassed throughout the world.

This, we think, is an appropriate time to say "thank you" to our loyal customers and to the members of our company "family" who have made this growth possible and who, together, have brought us to our semi-centennial year.

Won't you visit us at Booth 338 ASTME Show where the highlight of a large display of diamond tools will be demonstrations of the remarkable new Tru-Grit® Rotary Diamond Dressing Wheel—a major breakthrough in high-speed precision forming and dressing, and the first showing of the Tru-Vec Diamond Tool with its X-ray Vectored Diamond. You'll have a profitable visit.



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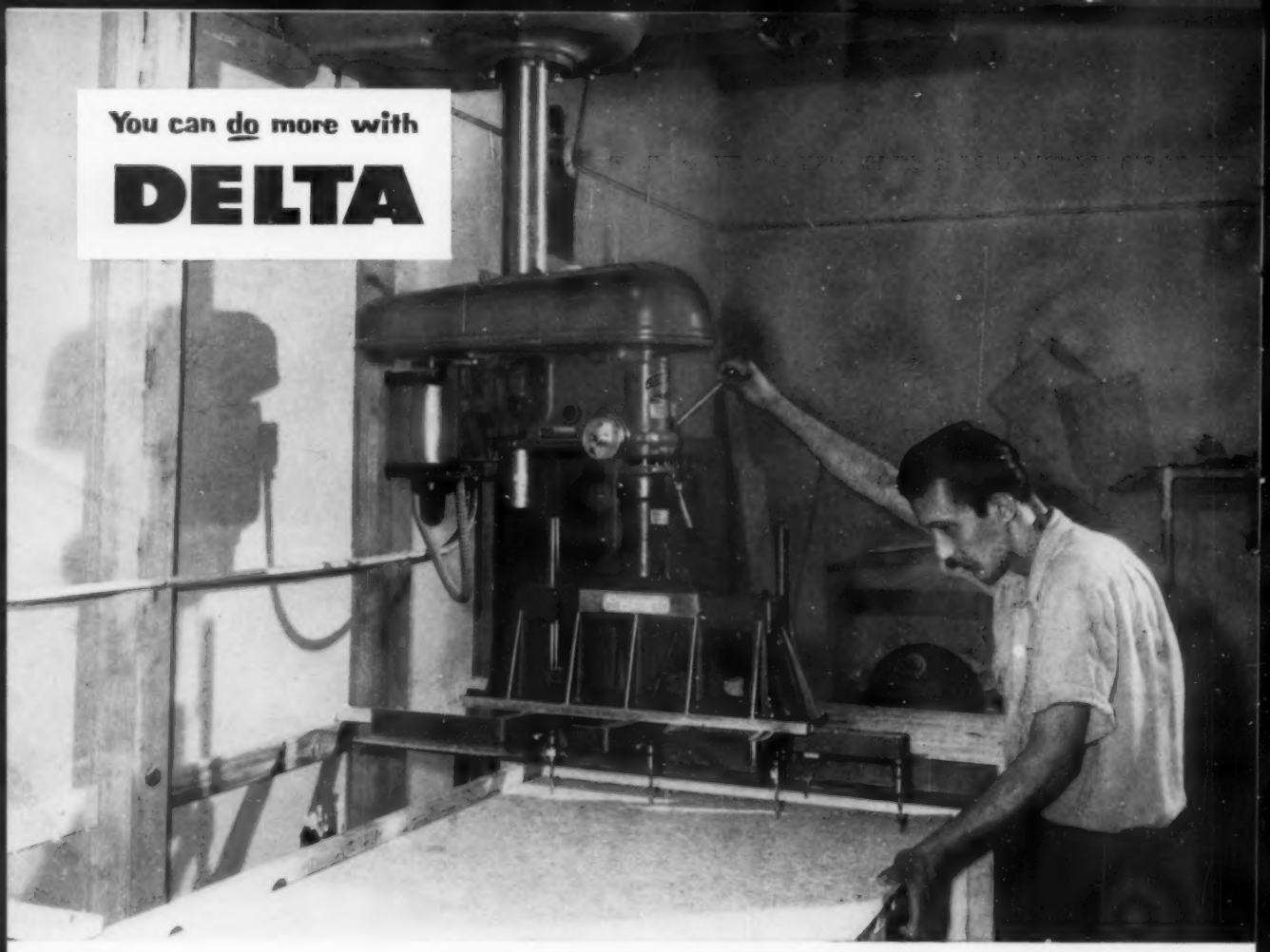

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Suspending a standard 17″ Delta drill press from an angle iron wall bracket over a table not only *doubled* productivity, but resulted in greater accuracy in wide panel drilling work for S & S Visual Company, a Brooklyn display firm. Use of a Commander multiple spindle drill head permits simultaneous drilling of up to 15 holes in a line 35″ long. Avoiding costly single-purpose equipment, the firm used versatile, standard Delta components for this relatively inexpensive installation.

Every model in the world's most complete drill press line offers the power, precision performance and ruggedness that have set industry standards for years. Delta drill presses give you better value for your money—they cost less to buy, less to operate and less to maintain.

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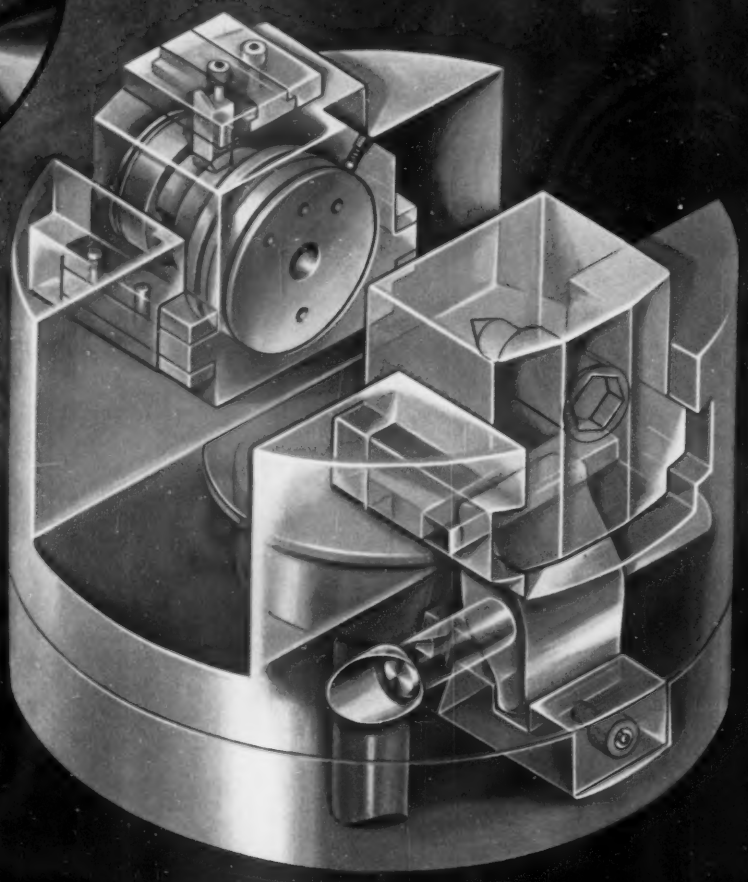
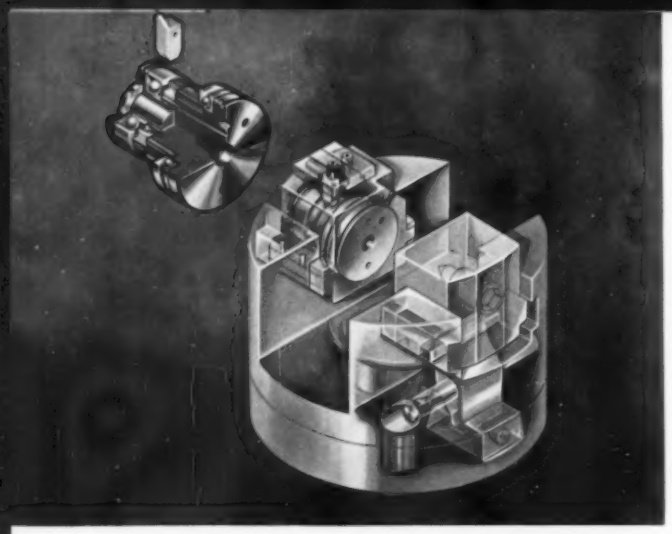


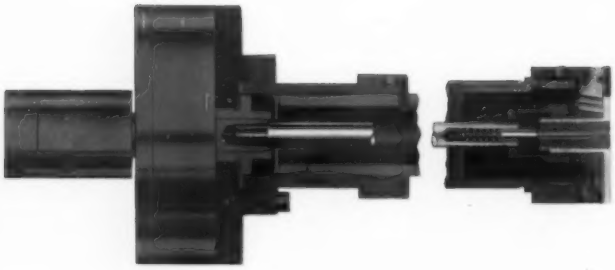
Here is another major chuck development from **SKINNER**



A heavy-duty power chuck with jaws that freely index under full pressure. Indexing is simple, easy, and fast. The operator can index manually without touching the work or releasing the pressure. Jaws are indexed by means of a lock screw and slide plate. Note the size and shape of the indexing pin. It fits firmly and positively into the indexing plate so that extreme accuracy of indexing is assured.

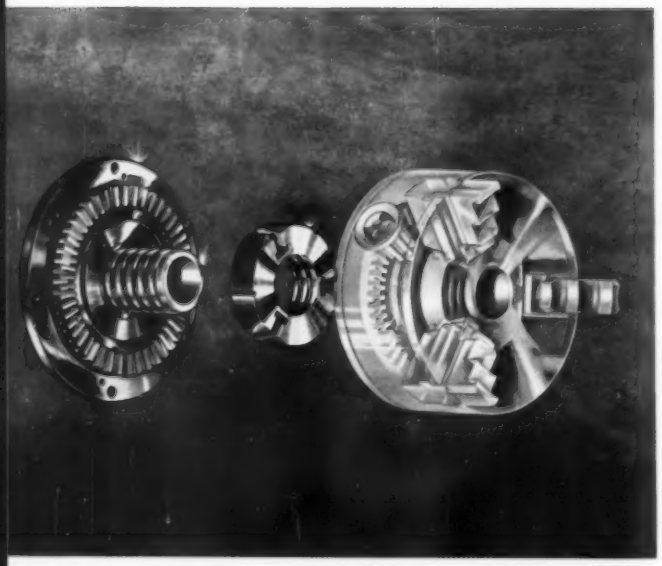
One or both jaws can be furnished with indexing mechanisms. As a result, you can index more positions and smaller index angles. There is no need to buy a new chuck for different indexing positions because index jaws or index components can be interchanged quickly and easily.

This new Skinner chuck is available in all body diameters from 12″ through 36″.



The only power chucking unit for Brown & Sharpe and similar automatic and hand screw machines. The addition of this unit to your screw machine permits power chucking of cold drawn parts, small or odd shapes and castings.

The Skinner unit, recommended by Brown & Sharpe, consists of a 4-inch air chuck with two or three jaws and work ejector, a threaded draw bar, a rotating air cylinder and a cylinder adapter. Hand, foot, or solenoid valves and power chucking accessories are also available. Average installation time—ninety minutes.



The first major chuck development in fifty years! This extra-heavy-duty Wedge-Screw chuck develops tremendous gripping power, high accuracy and repeatability by a unique principle. When the lug-type pinion is turned manually or by a power wrench, it engages the gear plate causing the screw to move the wedge. The force of the wedge on the jaws holds the work with tremendous power.

This Wedge-Screw chuck has such useful features as:

Accuracy—within .001 total indicator reading

Repeatability—within .0005 total indicator reading

Complete Range—no size limitation

Many other features including over-tightening and operator protection, sealed operating mechanism, automatic lubrication, etc.

For more information about these major chuck developments, contact your Skinner representative or write directly to us. Be sure to see all 3 of these products at the ASTE Show, Booth 1338.

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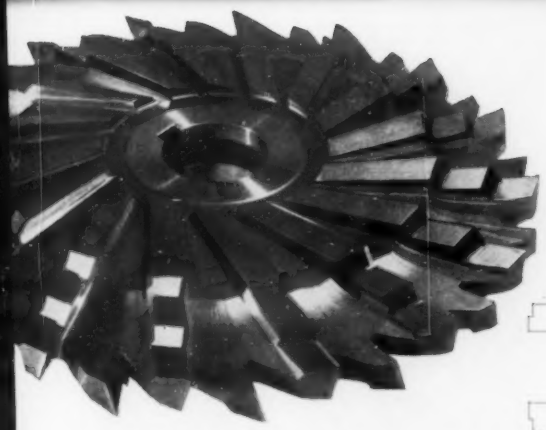
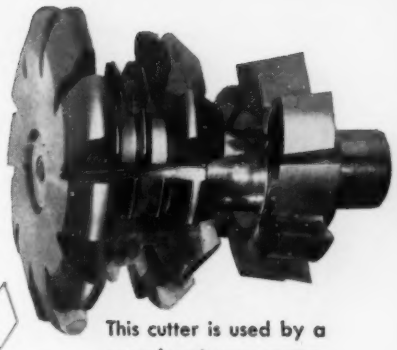


A special multiple-step milling cutter used by steam turbine manufacturer to cut stepped rotor slots for turbine blades.



This cutter is used by a prominent saw manufacturer to form mill the profile in dado blade sets for the wood working industry.

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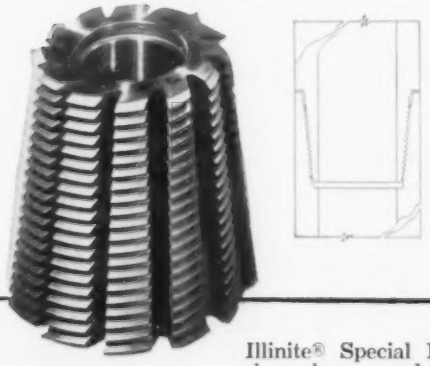
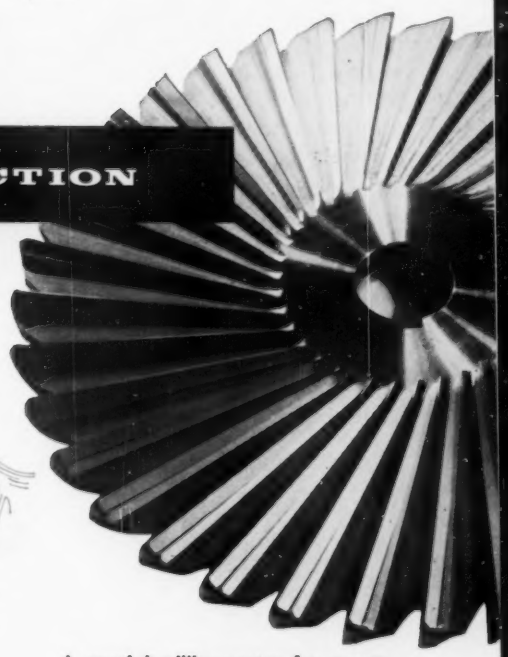
This tapered multiple thread mill cuts threads in pipe joints used in oil well drilling operations.





A special milling cutter for sweep milling impellers used in air conditioning and jet engine sections.

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(b) Illinois Tool engineering job-tailors your special milling cutters for maximum efficiency. ITW tool designers often combine several machining operations into a single cutter or gang, with consequent savings of considerable time per piece. Specially designed tools such as these also assure improved accuracy *since accuracy is designed into the tool,* and is not dependent upon several separate operations.

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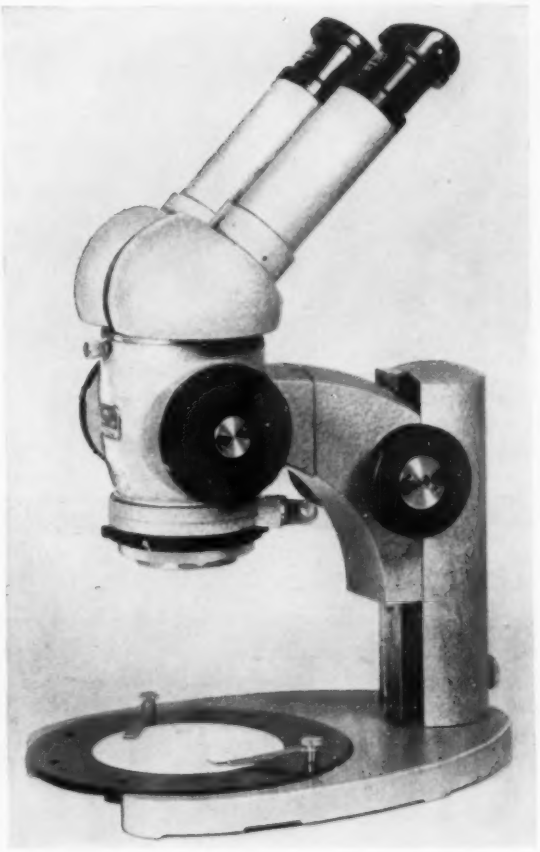

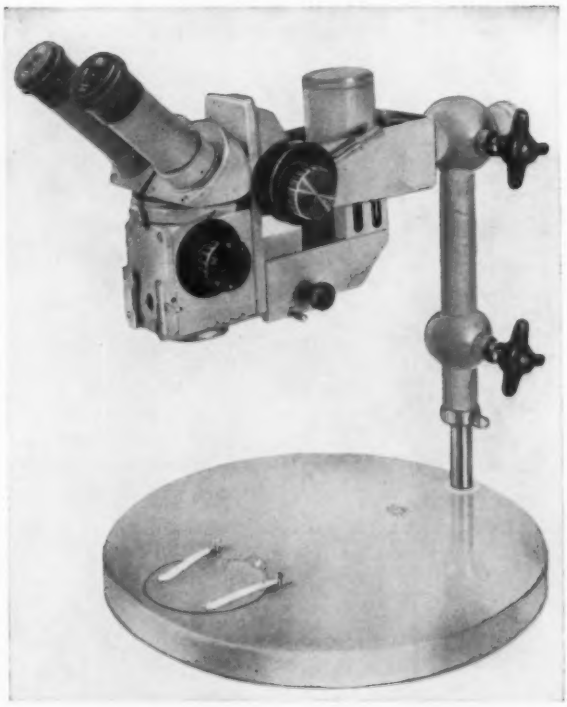

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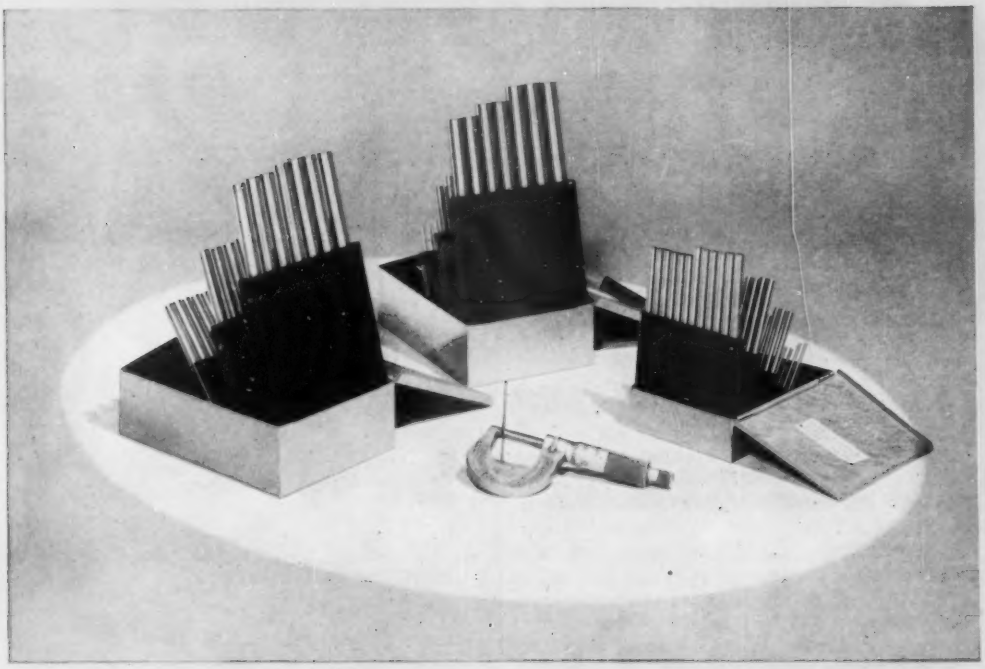

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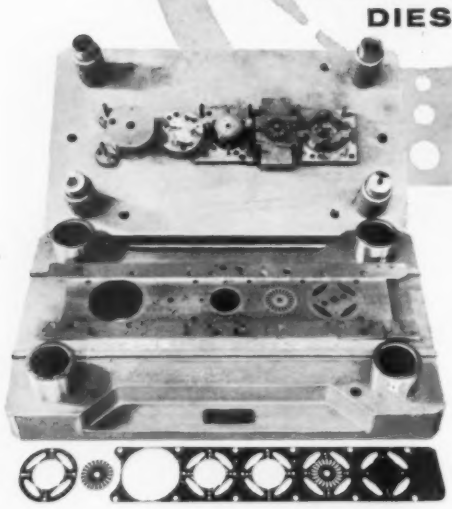

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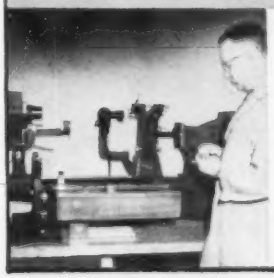

AT ADAMAS—using the latest metallographic equipment; Jack Powers, Supervisor of Metallography, submits the tungsten carbide discs to a microscopic examination, the final step prior to shipment. Rigid laboratory tests include: chemical analysis of powders, grain size checks, Rockwell hardness, density (weighed to .0001 grams) and transverse rupture strength of sintered pieces.

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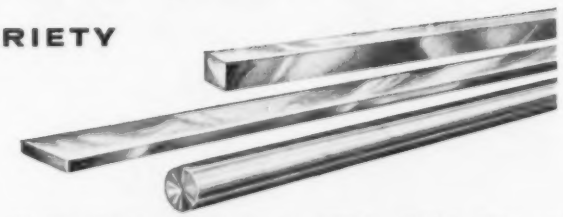

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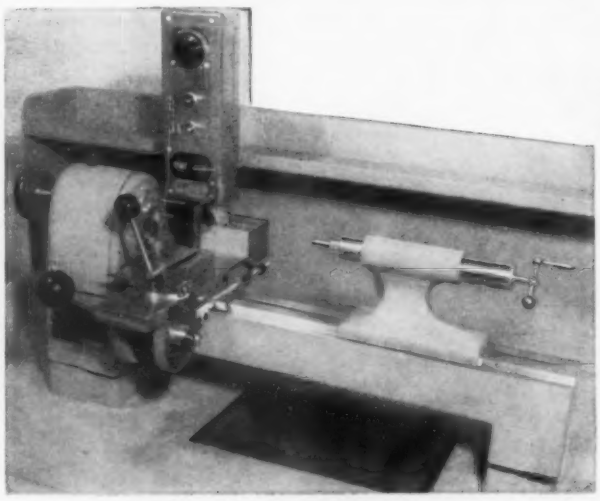

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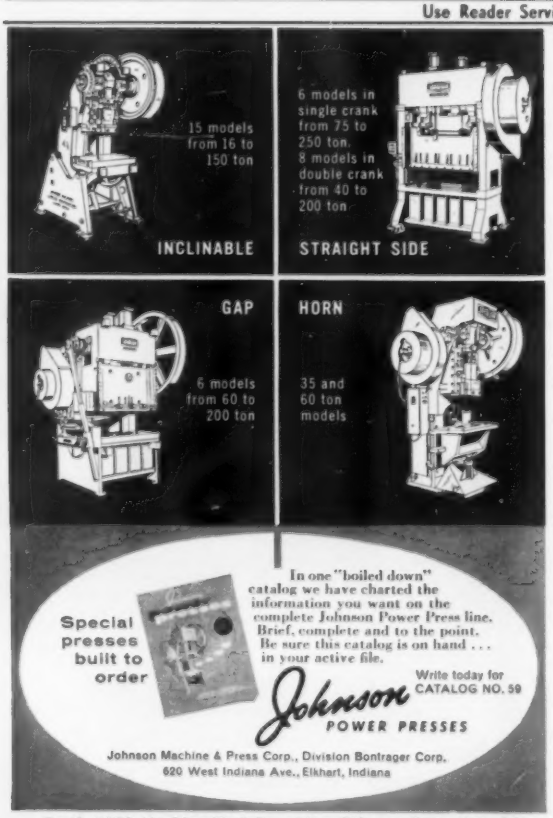
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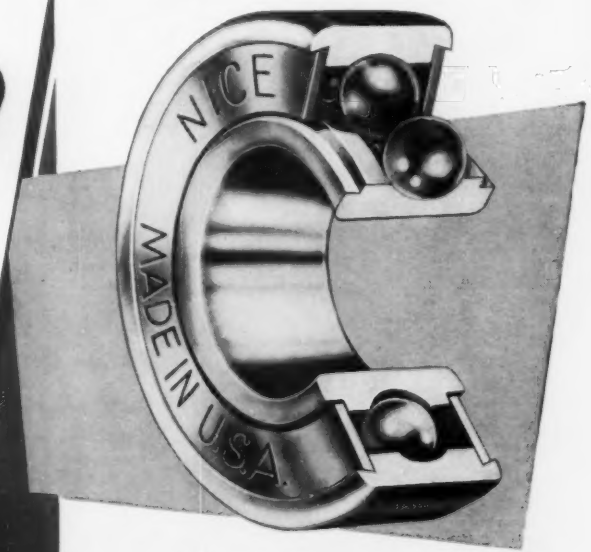

As illustrated above, the new UNIBAL Ball Bearing features solid inner and outer raceways, with deep, unbroken ball grooves, *plus* a full complement of balls.

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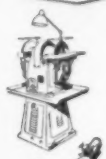

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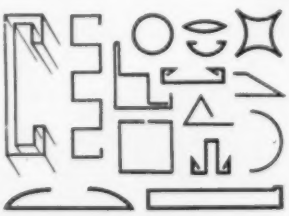

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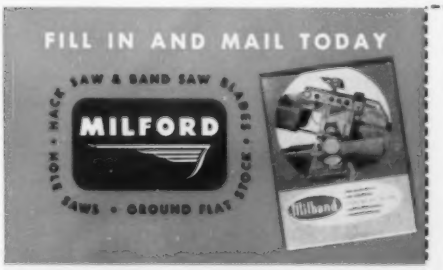

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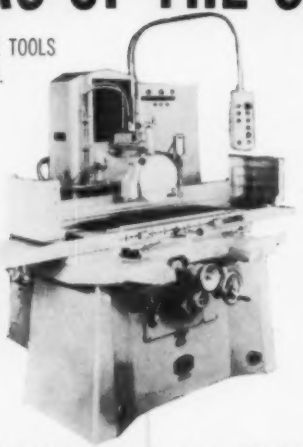

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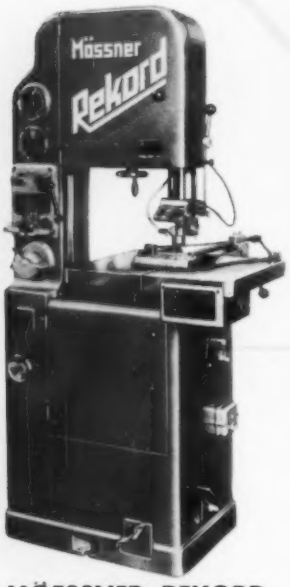

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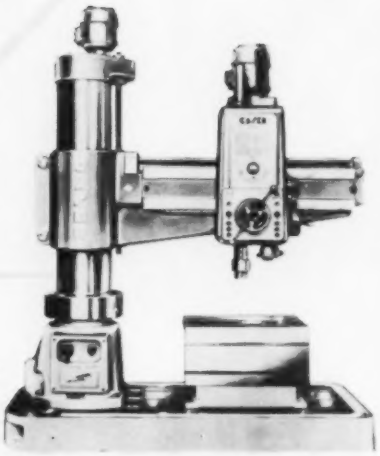

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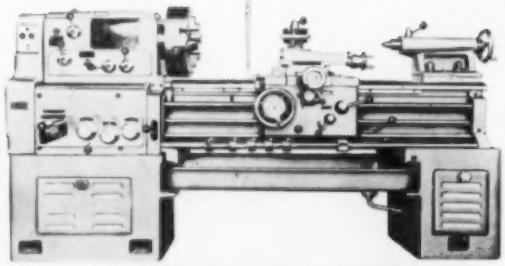

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Conclusion: the radioisotopes had attractive possibilities in industrial and medical radiography, emitting almost pure gamma rays or X-rays (photons) in the low energy range of 30 to 100 kev.

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This isotope radiography program is but one example of the work unde way in GM Research's modern isotope laboratory – work that means, through science, "more and better things for more people."

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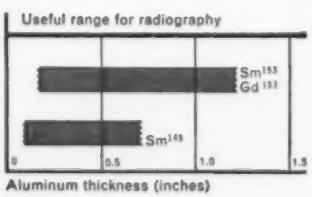
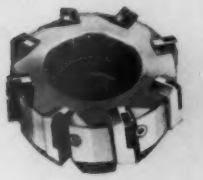
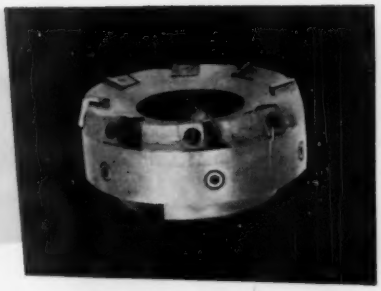
Warren, Michigan



Sm^{153} exposure unit.





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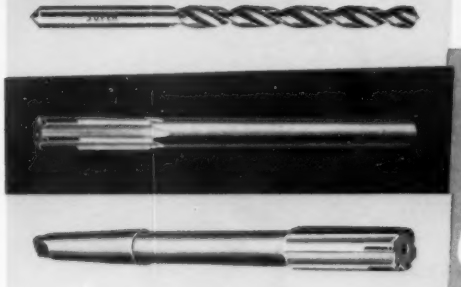

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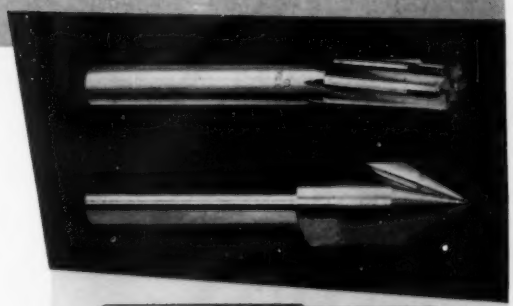

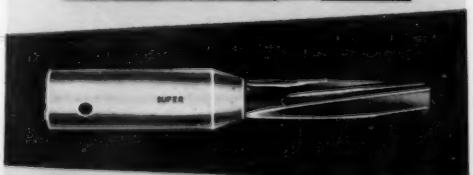

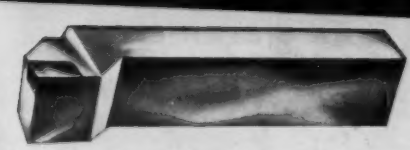

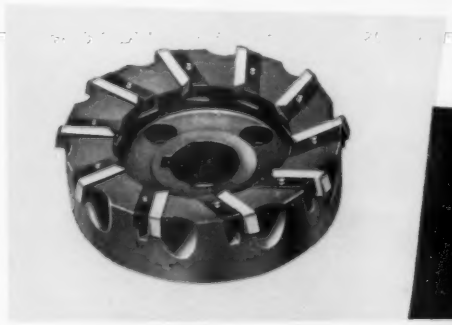

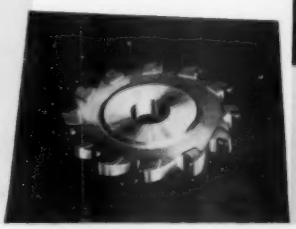

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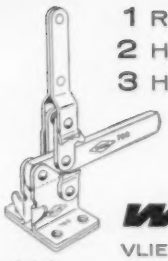

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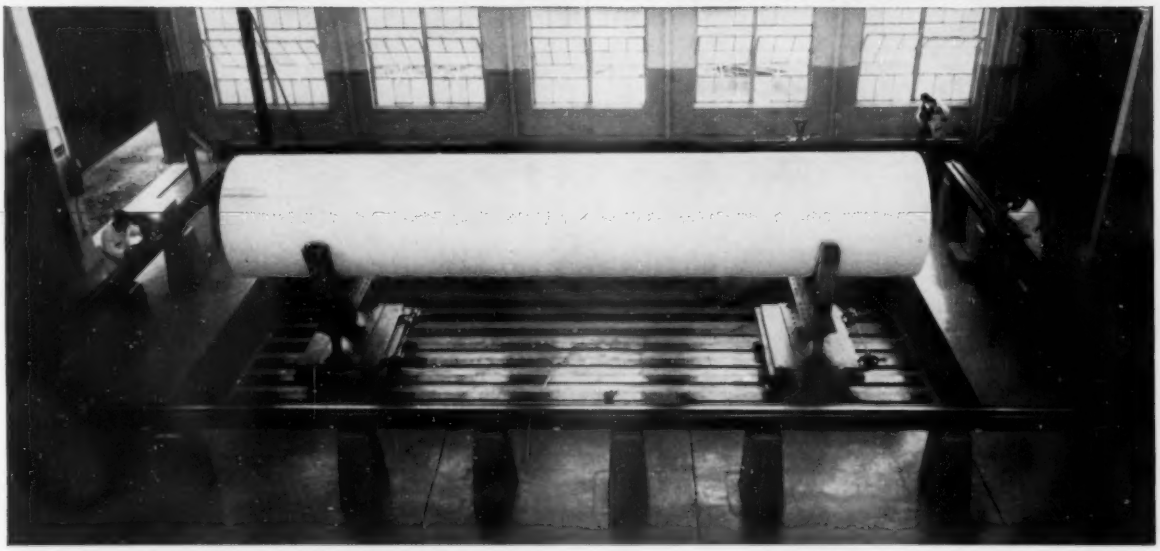

The close tolerance of ballistic shells demand great accuracy of measurement—a laborious, time-taking job with conventional equipment. Progressive Reynolds Metals Company, performing vital missile work has solved this problem with Brunson optical tooling equipment and the unique tooling dock shown above.

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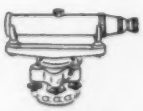
Look to Bruning for the *Complete* Line of Optical Tooling Equipment

Optical Transit Squares, Jig Transits



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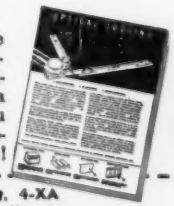
"Double-Line" Targets



This comprehensive 20-page booklet covers Brunson optical tooling—principles, applications, and equipment. It's a gold mine of information you would find difficult to obtain elsewhere. Yours free!

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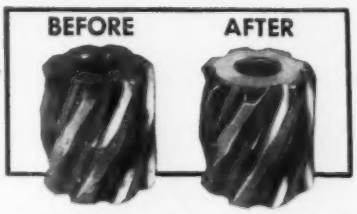

3 hand operations were eliminated by the Vibraslide machine in finishing this 21 oz. steel pinion gear.

The Vibraslide Finisher's new Vibrating-Rotating action is bringing the best results yet achieved in barrel finishing . . . . faster, and at a fraction of previous costs.

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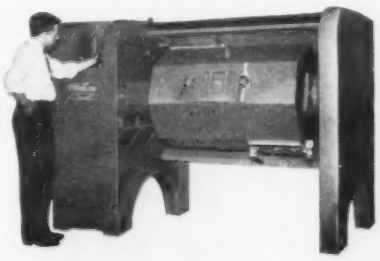

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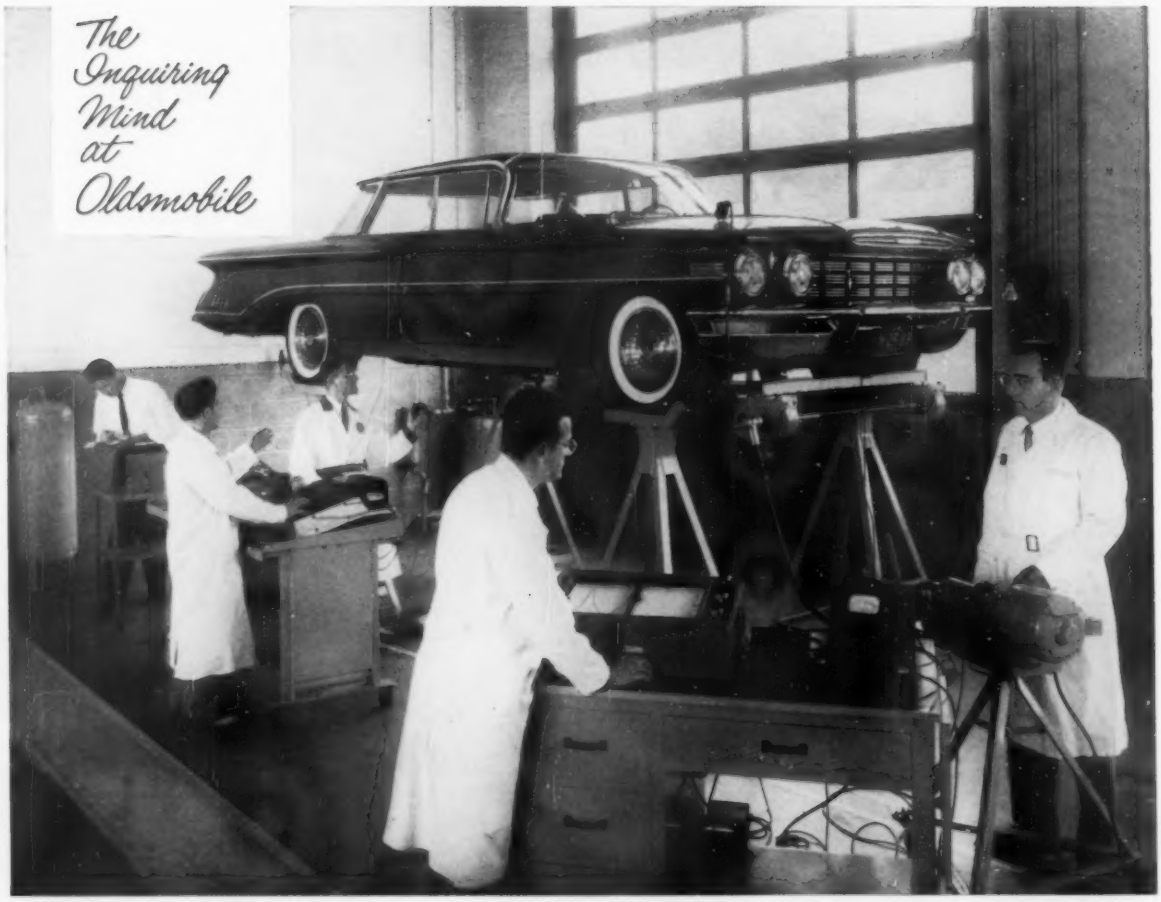

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One of the unique ways in which noise and vibration are isolated by Oldsmobile engineers is through Vibra-Tuned body mountings. These mountings—direct attaching points between the body and frame—are critical to comfort and to the life of the car. If they are not properly placed, severe road vibrations can literally shake the car apart in a few thousand miles. But, by using the most advanced electronic measuring techniques, a softer and quieter ride is achieved by placing the body mounts at the nodal points of the frame. In this way, inherent road vibrations and shocks are practically isolated from the passenger compartment.

In the "tuning" of the chassis and body, the car is subjected to severe shaking, at a frequency of 7½ to 15 cycles per second, by a mechanical oscillator to produce torsional and bending moments. By using numerous electronic pick-ups, movement of the frame and body at a given point can be determined quickly and translated into an accurate magnitude vs. frequency curve through an X-Y plotter. By a complete and thorough examination of the entire car in such a manner, it can be determined where the "dead" or nodal points are on the frame, and the body mounts can then be scientifically placed. Then, after being located, the hysteresis characteristics of the body mounts are determined to give the most satisfying ride.

These methods, and many more up-to-the-minute techniques, have enabled Oldsmobile engineers to build consistently fine quality automobiles year after year. Visit your local authorized Quality Dealer and drive a 1960 Oldsmobile. See why it's the most satisfying car you've ever known . . . *the finest the medium-price class has to offer!*

OLDSMOBILE DIVISION • GENERAL MOTORS CORPORATION

OLDSMOBILE **Where Proven Quality Is Standard!**

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FOR THE FIRST TIME! REAL INTERCHANGEABILITY IN UNITIZED TOOLING

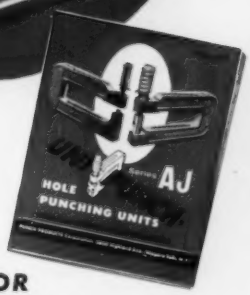
NEW UNIPUNCH "AJ" Series provides not only INTERCHANGEABILITY with UNIPUNCH Series "A"—but also with units and parts of other leading manufacturers!

In keeping with the UNIPUNCH Series "A" Hole Punching and Notching Units this new UNIPUNCH "AJ" Series has the popular "standard" 8⅜" shut height, 3½" die height and the same maximum capacity of ¼" thick mild steel permitting all these Units to be used in the same setups.

All-steel cast holders produce longer life by combining higher tensile strength and longer wear plus greater bearing surface for punch guides than previously available in this type of holder.

USING PEDESTAL DIES Pedestal Die design is ideal for punching holes in angles, extrusions, channels and formed parts with lips or flanges. Slug chutes in these Pedestal Dies may be directed to prevent piling up of slugs—an important feature in making setups for punching a cluster of round or shaped holes.

USING DIE ADAPTERS UNIPUNCH Type "AJ" Hole Punching Units with Die Adapters provide inexpensive Die Button replacement plus quick, easy interchangeability of standard low-cost die buttons—same as used in UNIPUNCH Type "A" and "B" Hole Punching Units.



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10 TON AIR-HYDRAULIC PRESS

UNIPUNCH PRESS with UNIPUNCH TOOLING punches holes in sheets, angles, channels and extrusions plus notching operations...more economically and more efficiently.

Only UNIPUNCH PRESS has ALL these *features:-*

Exclusive (pat. applied for) hydraulic control provides self-adjusting, self-compensating power stroke with positive stop automatically determined by punch break through in metal, eliminating close ram adjustment when punching various thicknesses of material. Removable ram nose or cap on press ram permits use of detachable vee dies, marking heads and short stroke die sets for small bending and marking operations. Ram can be jogged by foot control.

Simplicity of design (air-hydraulic) • Minimum of moving parts • Operates at 10 tons from 75 pound air line pressure • 100 strokes per minute • 1⅞" ram daylight adjustment • Foot operated control • No double stroking • 15½" throat depth without gauging • Gauging from center of ram to left 24" and front to back 12" (punches to center of 24" sheet) • Gauging equipped with 7 adjustable stops—Optional gauging over 24" available.

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Atrax

Precision Ground

SOLID CARBIDE TOOLS AND BURS

Job Applications

NEW ATRAX MICRO-DRILLS ADD UNUSUAL PRECISION TO MINIATURE DRILLING OPERATIONS!

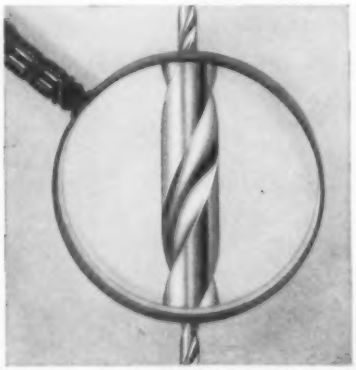
It is now possible to get rugged solid carbide performance and "watchmakers" accuracy in miniature drills.

COMPLETE RANGE OF WIRE SIZES

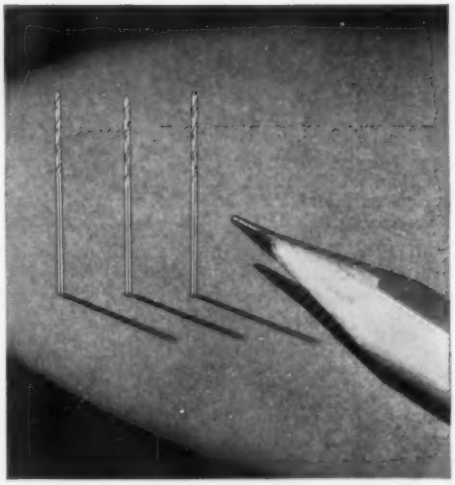
The new Atrax MICRO-DRILLS in wire sizes #61 through #80 have diameters ranging from .0135 to .0390 and complete the Series 1815 now making wire drill sizes #1 through #80 available from stock as "standards" at no extra cost.

BIG DRILL EFFICIENCY . . . IN SMALL SIZE

Solid Carbide throughout, the new Atrax MICRO-DRILL is precision ground, standard right hand spiral, has straight shank, machine ground point and is right hand cutting.



NOTE: Big drill uniformity and detail on magnified section of #70, diameter .0280" MICRO-DRILL.



ABSOLUTE UNIFORMITY

Drill diameters are held to tolerances of +.0000 −.0005. Precision ground flutes and O.D. adds micro-precise uniformity to small, demanding drilling operations.

DRILL MANY MATERIALS

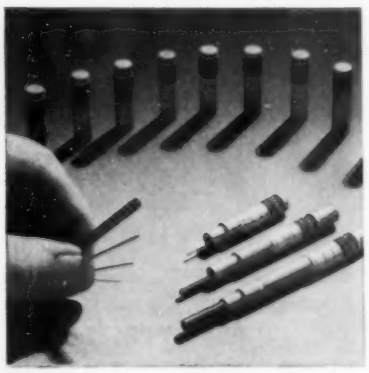
The new 1815 MICRO-DRILL is especially recommended for drilling plastics, fiber, Fiberglas, carbon and other non-ferrous materials. The MICRO-DRILL has also been very effectively tested on electrical and electronic circuit board work.

NEW SOLID CARBIDE DRILL BLANKS ALSO AVAILABLE IN WIRE SIZES

Atrax has also added a new 1825 Series of wire size drill blanks, #1 through #80.

Ranging in diameter from .0135 to .2280 these blanks are precision ground from Solid Carbide to tolerances of +.0000 −.0005.

Series 1825 drill blanks are available now from stock through local industrial distributors. Special blanks and grades are available upon request.



We feel that this information can help you improve production, lower costs and discover the superiority of Atrax Solid Carbide Tools and Burs.

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Booth No. 947

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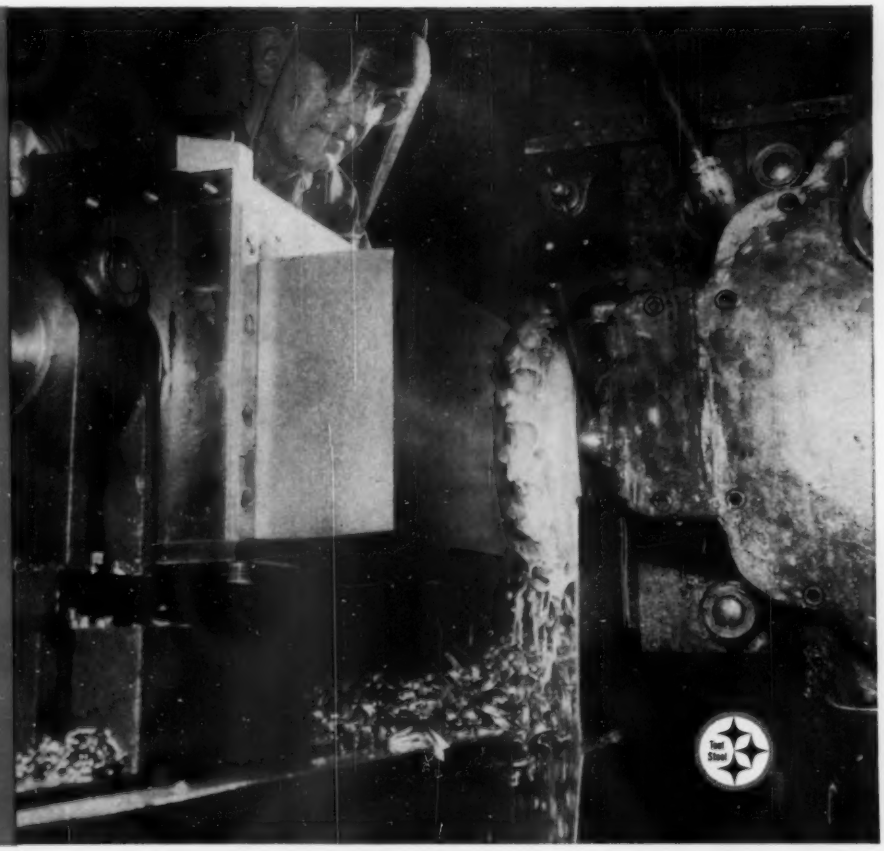

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. . . easier to work . . . easier to machine

In the production of thousands of metalworking dies, the properly dispersed alloy sulphides in Latrobe's FM High Alloy Die Steels have permitted increased feeds and speeds—*machining time cut up to 15% in most cases!* This cost-saving production is possible with no sacrifice of the excellent toughness, wear resistance and hardenability properties of the steel.

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Four grades of 12% chromium FM steels are regularly stocked: Olympic FM (type D-2) for long-run applications; BR-4 FM (type D-7) for extreme abrasion resistance; GSN FM (type D-3) for severe non-deforming requirements; Cobalt Chrome FM (type D-5) for extra resistance to galling and pickup.

For better die steels and technical service, call your nearest Latrobe representative. Literature on grades available upon request.

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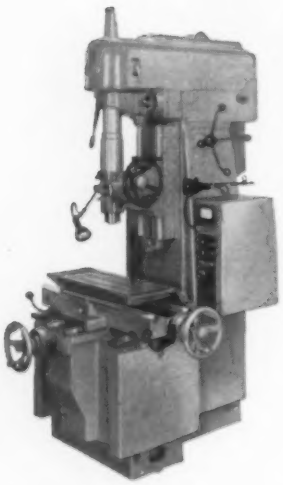

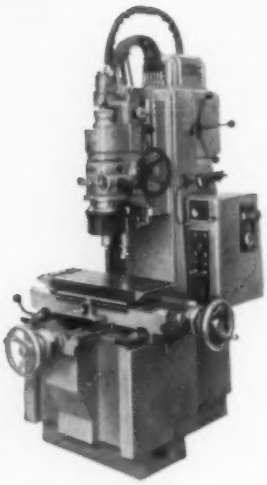

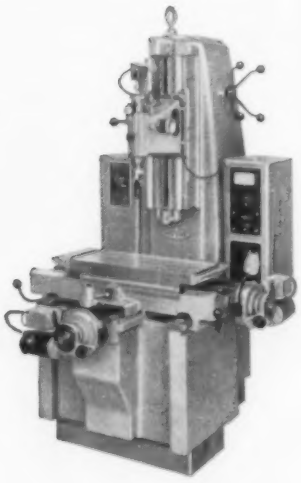

LOCATES AND BORES HOLES TO LESS THAN A "TENTH"

No. 3 Moore Jig Borer

For boring, drilling, reaming and spotting holes in dies, jigs and production parts, the speed and accuracy of the Moore Jig Borer has never been equaled. Now, with this new and larger No. 3 model, you will break the "tenth" barrier! Here's why: it offers more precise positioning tolerances...all hardened, ground and lapped ways...no gibs...no overhang...improved drive...wider speed range 60 to 2250 RPM...larger table working surface, 11" x 24"...micro setting of vernier dial...more accessible cross-clamping. These new features, plus sensitive, centralized controls for spindle speeds and feeds, quick tool-changing, easy lubrication add up to a Jig Borer which belongs in every toolroom where *tomorrow's* accuracies must be achieved *today!*

LOCATES AND GRINDS HOLES TO LESS THAN A "TENTH"

No. 3 Moore Jig Grinder

The originators of jig grinding and the Jig Grinder have done it again! Now, with this new, larger No. 3 model, you can grind—*with split-tenth accuracy*—holes plus regular and irregular contours to size and location after hardening. This is made possible by the closer locational tolerances built into the machine...by the all-hardened-ground-and-lapped ways...by the faster strokes provided for chop-grinding...by the infinite spindle speeds, 40 to 250 RPM...by the larger table working surface, 11" x 24". The same quickly set precision lead screws as in the Moore Jig Borer simplify the finish-grinding process.

MEASURES TO ONE-THIRD OF A "TENTH"

Moore Universal Measuring Machine

This machine, built on the same basic principles as the No. 3 Moore Jig Borer and No. 3 Moore Jig Grinder, introduces a new concept in ultra-precise measurement and inspection. It offers *for the first time:* A machine combining the capacity for larger work-pieces; choice of electronic indicator supported on an accurate, rotatable spindle, or a universal microscope for pickup; a combination of rectilinear and angular positioning, making possible the measurement of the most complex contours. Design and construction insure the highest possible accuracy. All ways are hardened, ground and lapped steel, fitted to hand-scraped cast iron. Table positioning in two directions of travel is by means of master lead screws. Note motorized lead screw drive—it's optional (for Measuring Machine only).

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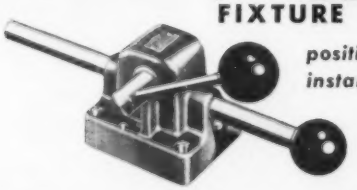

positive clamping
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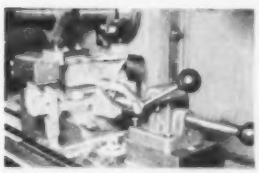
SIMPLIFY JIG AND FIXTURE DESIGN

LONG TRAVEL provides plenty of chip clearance, easy loading and unloading. Gets into hard-to-reach places. Base sizes: Model 2FL, 3⅛" x 3¼"; Model 9FL, 4⅜" x 3⅝". Bar lengths from 8" to 18". Here are two examples of Grip-Masters speeding production in drilling and milling operations.



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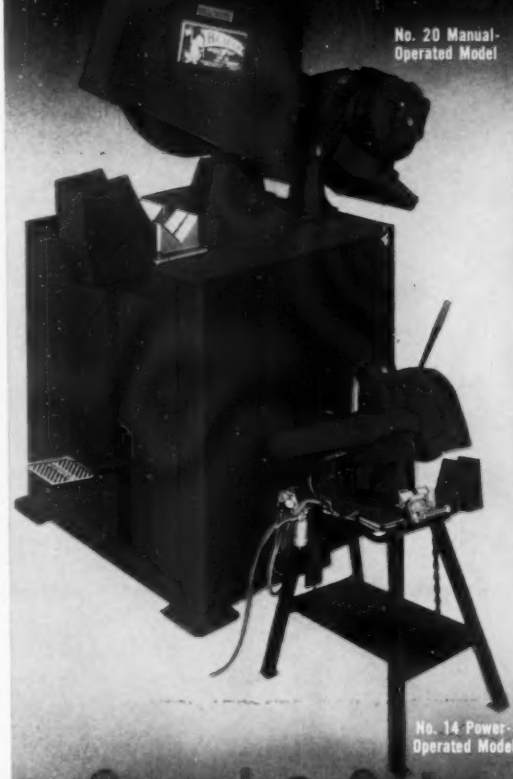

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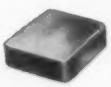

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yet move easily from job to job

3 sizes for all tooling needs

SMALL WORK MODEL 1—⅓ hp., removes metal at ⅓ cu. in. per minute,* 10" min. lathe mtg.

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LARGE WORK MODEL 3—1½ hp., removes metal at 1½ cu. in. per minute,* 18" min. lathe mtg.

*in mild steel

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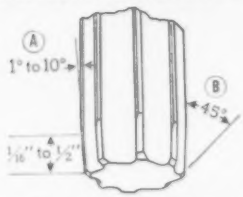
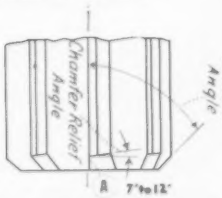
REAMING TIPS YOU CAN USE

SECONDARY CHAMFER



Grinding a secondary chamfer angle as illustrated (A) is often recommended. It is useful in applications where a fine finish or close tolerance is required. (B) is the regular chamfer.

KEEP IT SHARP



A chucking reamer is an end cutting tool. The cutting edges are produced by the chamfers at the ends of the lands. (A) To obtain maximum performance, the chamfers and clearance relief should be reground before excessive wear develops. Each chamfer should be ground exactly even or the tool may cut oversize.

OVERCOMING CHATTER

To end chatter in reaming, try Chicago-Latrobe's Duo-Spiral Reamer. The alternate left and right hand helixes tend to dampen cutting vibration; eliminate hogging; produce more accurate, better finished holes.

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"LO-TORK" CHIP BREAKER DRILLS

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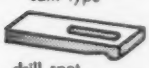
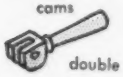
slotted heel

cam type


drill spot

single cams


double cams

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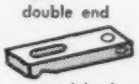
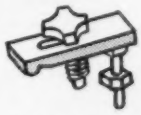
double end


tapped heel

swivel heel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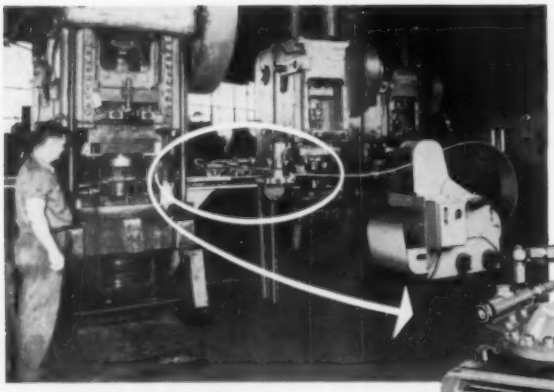

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Model AFR-1818 shown with Pull-Thru Stock Leveller attached.

• The Ses-Matic "SPACE-SAVER" Line featuring the Ses-Matic Air Feed, Pull-Thru Stock Leveller and Coil Cradle.

Ses-Matic Double Air Feed for materials up to 72 inches wide. This unit feeds stock 72" wide by .074 thick and removes coil bend with a Pull-Thru Leveller.

Ses-Matic Air Feed for wide stock up to 30 inches wide. Stock is supported on roller wheels.

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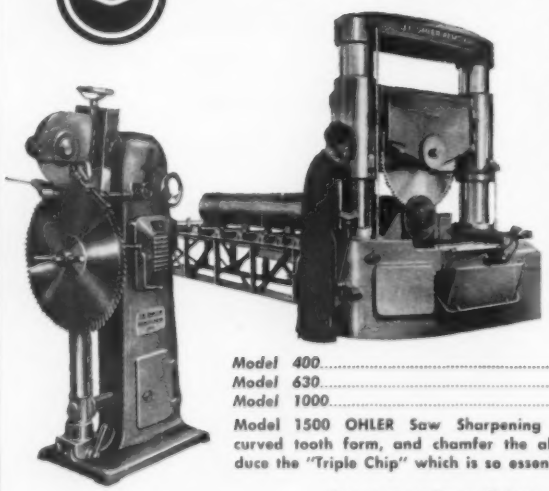

OHLER Hydraulic Cold Sawing Machines are made in three sizes in the following capacities: All machines are available in KA Models for automatic and semi-automatic operation and Models K for semi-automatic operation only.

CAPACITIES

Model 400	*5" Round*
Model 630	*10 3/4" Round*
Model 1000	*15 3/4" Round*

Model 1500 OHLER Saw Sharpening Machines will grind the curved tooth form, and chamfer the alternate high teeth to produce the "Triple Chip" which is so essential to modern cold sawing.

- Hydraulic Cold Sawing Machines
- Automatic Saw Blade Sharpening Machines

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- Segmental Saw Blades
- Solid Metal Saw Blades
- Friction Saw Blades

The most modern, efficient and economical cold sawing equipment. All models in latest design, for full automatic cutting will be exhibited in operation at the ASTE Show—BOOTH NO. 555—Detroit Artillery Armory, April 21-28, 1960.

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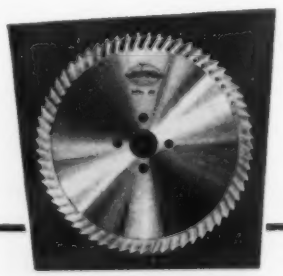

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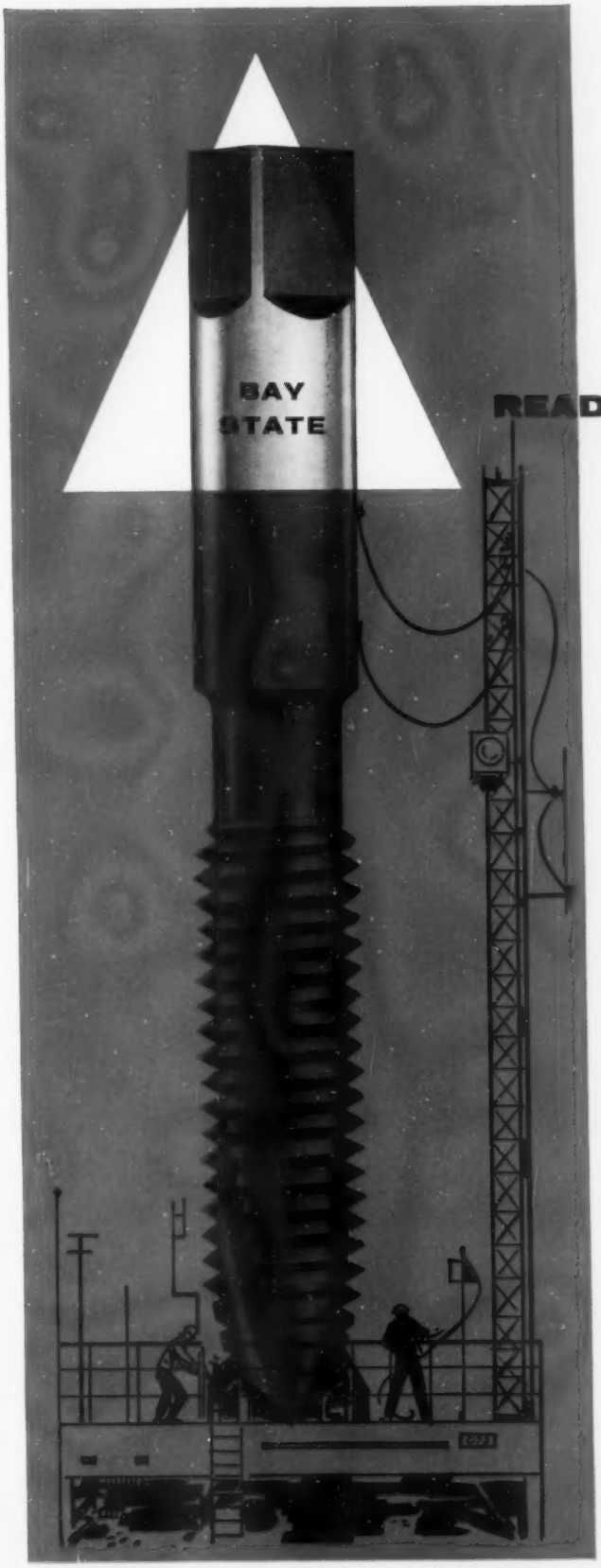

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READY FOR IMMEDIATE DELIVERY...

A Precision Tapping Performance

Bay State Announces New Sales and Service Facilities

8 New Stockrooms — *strategically located and fully stocked* — provide your distributor with immediate delivery of precision performance Bay State taps.

"Rapid Wire" electronic system assures up-to-the-minute communication between all stockrooms and factory.

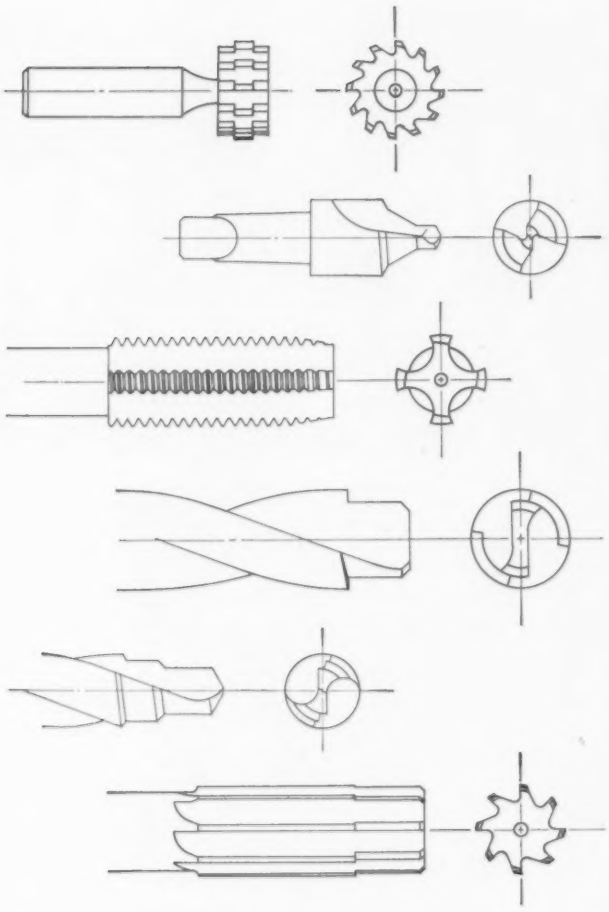
Expanded staff of Bay State application engineers — tapping specialists provide undivided attention to your tapping problems.

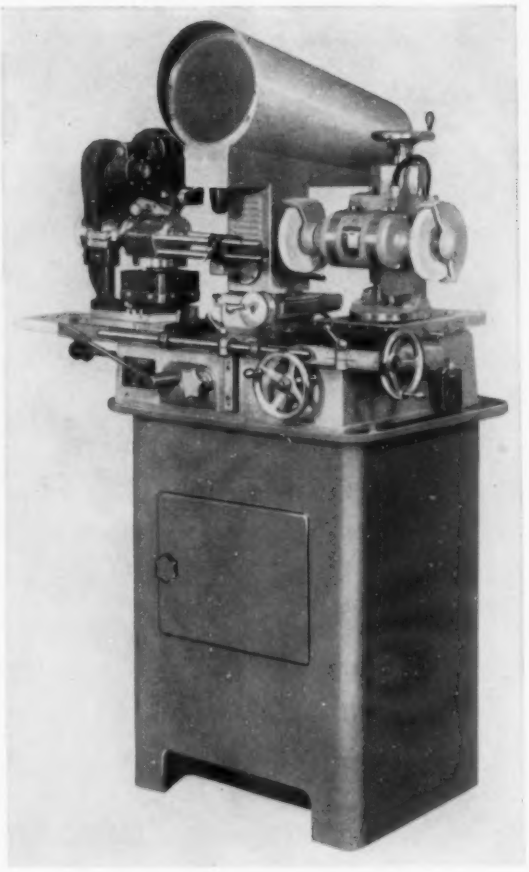
Specifying Bay State taps results in *Immediate Delivery Of Precision Performance* Tapping from the nearby shelves of your Bay State Distributor.

STOCKROOM AND FACTORY LOCATIONS

BAY STATE TAPS

Bay State Tap & Die Company • Mansfield, Massachusetts





SEE IT OPERATE! A.S.T.M.E. SHOW – BOOTH 560

SEE THE NEW SWING-IN, SWING-OUT COMPARATOR AND OTHER ATTACHMENTS THAT ADD FURTHER TO ITS VERSATILITY

There is always a crowd at the R-O booth because metalworking men are always looking for ways to do things better. Here's a tool that produces form relief on cutters, adding to their life and cutting ability—that does a dozen and one jobs in the tool room faster and easier than they've ever been done before. It's in use on thousands of jobs across this country and in 14 foreign countries —R-O engineers have never stopped trying to make it better and more efficient. Maybe that's its appeal—you always learn something new when you see it operate.

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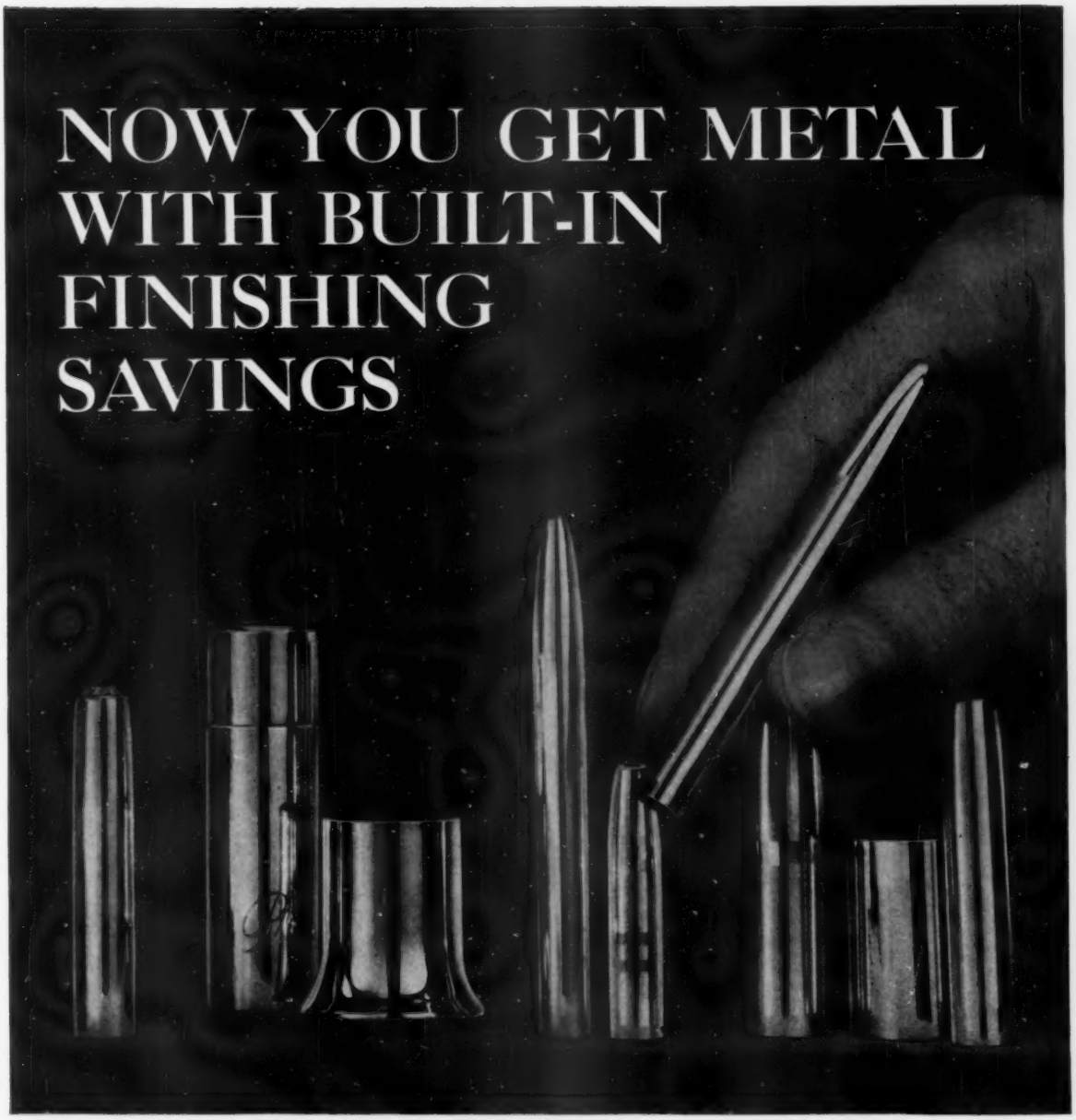


Faster production and up to 40% cut in polishing costs are made possible by superfine-grain structure of Formbrite® Drawing Brass

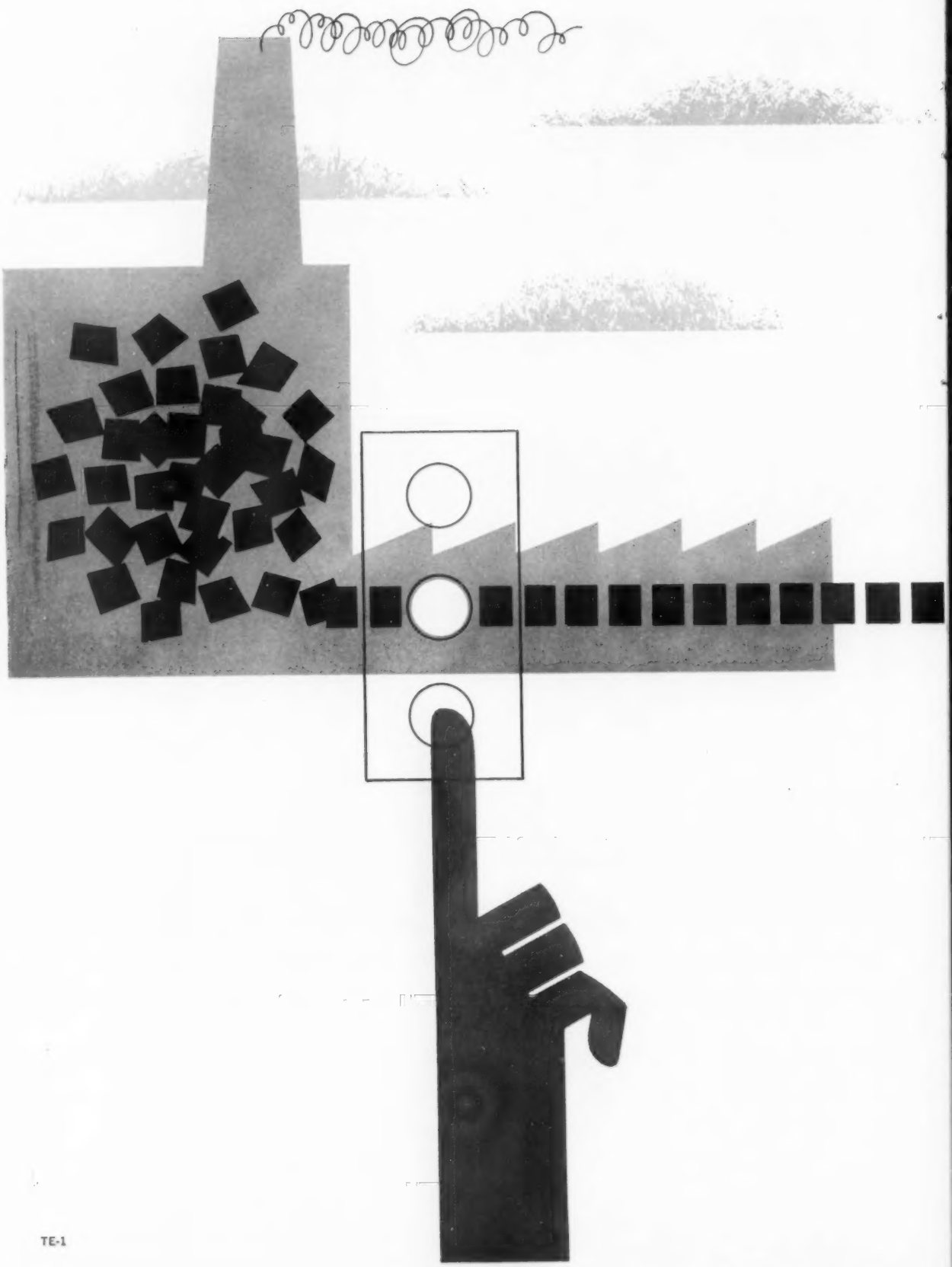
The jeweler's finish which Accurate Forming Corp., Franklin, N. J., gives pen caps and barrels previously meant the use of five polishing heads and a time bottleneck in production—resulting in a high polishing "cost factor." After switching to Red Brass-Formbrite, they use two polishing heads for a light cut and another for a simple color buff and run the machines faster. Savings run up to 40%. The secret of Formbrite is its superfine grain, produced by special rolling and annealing techniques. Formbrite is springier, harder, more scratch-resistant than the usual drawing brasses in the same standard tempers, yet retains remarkable ductility for forming and drawing. Despite its superiority, *Formbrite costs no more than ordinary drawing brass.* Get full details from your Anaconda representative or write: The American Brass Company, Waterbury 20, Conn. In Canada: Anaconda American Brass Ltd., New Toronto, Ont.

FORMBRITE

SUPERFINE-GRAIN DRAWING BRASS AN

ANACONDA®

product made by The American Brass Company



TE-1

Are you working toward automatic machine tool control?

The means by which instructions are reduced to the language of machinery and conveyed as intelligible orders to that machinery comprises the system complex which makes automatic control possible.

For many years North Electric has been designing, engineering and manufacturing such system complexes, over 5,000 of which are in operation today!

The selection and application of components, a thorough understanding of advanced switching techniques and complete familiarity with complex circuitry design are but three of the many highly specialized areas demanding unique capabilities and which are frought with danger for the uninitiated. This is the professional climate in which the experienced, system-concept-minded engineering group at North Electric works constantly and continuously!

If you are working toward automatic control of machine tools and automation of production machinery, you cannot help but profit when you call on the most experienced system group available.

If these are your goals—you'll want NORTH on your team. Write, wire or phone for an appointment to learn how much North can do for you.

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Quickly Diamond Lap tools down to 1 - 2 micro-inch finish for STRONGER — LONGER LASTING cutting edges. SPECTRUM'S exclusive PS219PC 6" Lapping Wheel, 5 gram tube Gold Label SPECTRUM Diamond Lapping Compound, Charging Roller, Oil and Atomizer completely equips your standard 6" offhand Grinder.

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PUSH BUTTON *Speed Selection*

from to in seconds

or to *any* intermediate speed, *instantly*

Just push a button and watch the large tachometer dial on the headstock!

It's that easy!

The work is done by a motor driven speed changer. It accelerates or slows the lathe to any desired speed in seconds. With a 10:1 ratio, this new variable drive makes it easy to select from a wide range of speeds—200 to 2000 rpm in direct drive and 40 to 300 rpm in back gear.

Maximum stability and smooth power transmission are assured because the drive unit is oversized. All pulleys and shafts are fully supported (eight bearings). Double V-belts throughout the drive eliminate slippage and deliver full power to the spindle. Because of this rigidity and extra pulling power, this lathe will take heavy cuts at all speeds and precision finish cuts at high speeds.

It is a precision lathe, moderate in price, with the versatility for toolroom, production or second operation jobs.

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Illustrated WM56P 13" Swing- 34" Centers

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10", 11", 13" and 15" SHELDON Precision Lathes (Bench, Pedestal and Cabinet types)

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Punchability + REPORTS

Check Report Desired

☐ R. R. 22 **Tool Wear in Cutting Thin-Gauge Sheet Steels by Otto and Werner Kienzle**

Translation from German, made available by Armco Steel Co., embodies new data, tells of research in 3 groups of sheet materials, why rough punched faces are preferred. *Price .75 (non-member 1.50)*

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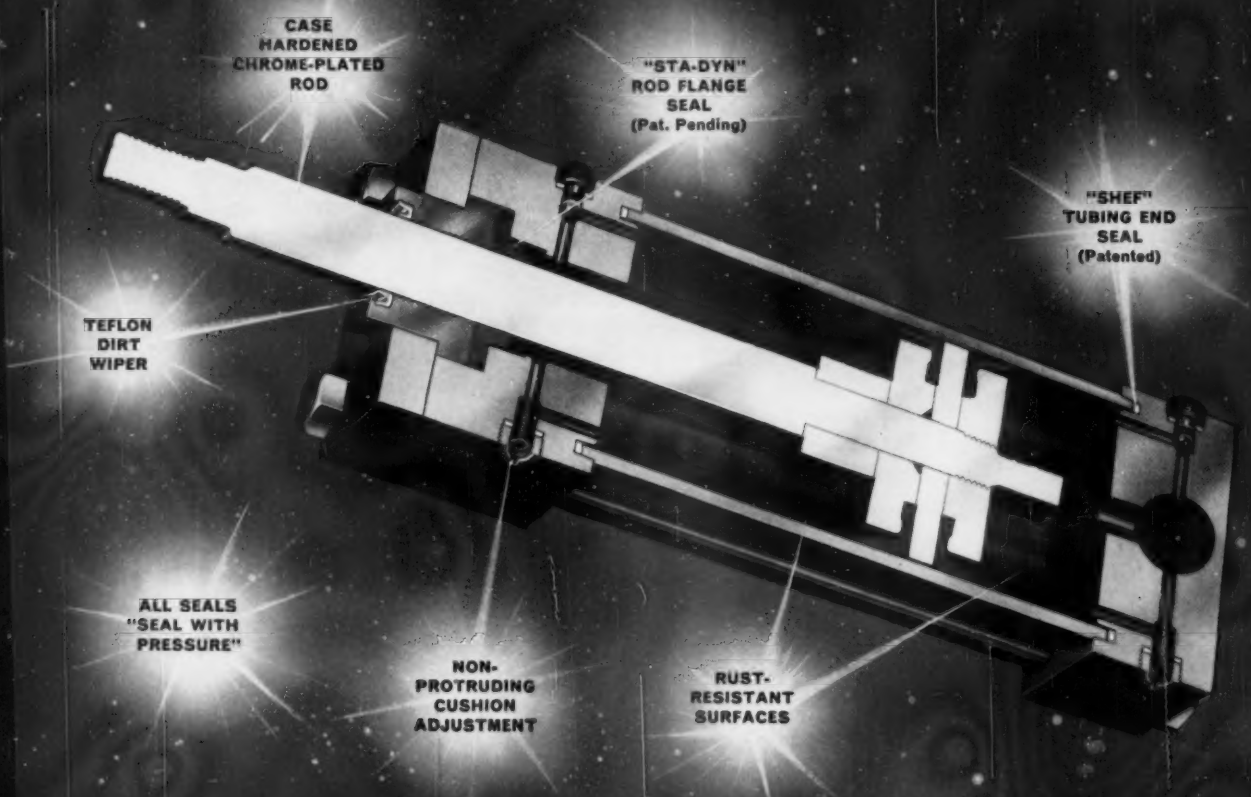
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"STA-DYN" ROD FLANGE SEAL (Pat. Pending)
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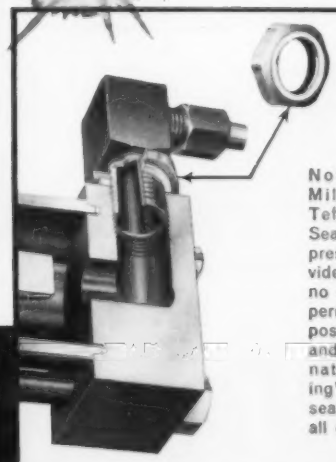
Miller AIR CYLINDERS

PORT SEALS



Now—with every Miller Cylinder—Teflon-sealed Port Seals that "Seal with pressure" are provided as standard at no extra cost. They permit much faster positioning of lines and fittings, eliminate "overtightening" damage, and seal perfectly against all operating media.

Here are eight more reasons why Miller Air Cylinders continue to be the most economical and reliable cylinders that money can buy. These stellar features—including the new port seals—are standard Miller construction—yours at no extra cost. Thus, they provide appreciable savings in original investment—*particularly for those who insist on "J. I. C." quality throughout.* Savings in operating costs are even greater, because these features are proven assurance of longer cylinder life, greater efficiency, reduced maintenance and downtime.

Specify "Miller" for greater reliability and economy! Write for bulletin.

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MILLER FLUID POWER

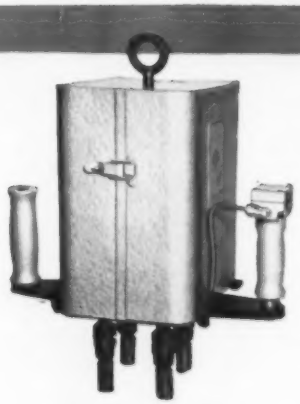
7N019 York Road, Bensenville, Illinois

See how you can boost productivity with GARDNER-

1 ONE AIR MOTOR MAKES 1,173 SPECIFIC TOOLS!

That's what we mean by air tool versatility and interchangeability. Here's how it works: Your Gardner-Denver Air Tool Specialist starts with the basic air-motor unit—our new, quiet, powerful No. 3 motor. By selecting from a variety of "building block" handles, reduction gears, attachments and clutches, he can assemble a total of 1,173 *different air tools*. Larger or smaller air motors provide a comparable range of tools in other sizes. Each Gardner-Denver screw driver, nut setter, wrench or drill is just right for solving a specific problem for you.

Here's what you'll see at the Gardner-Denver



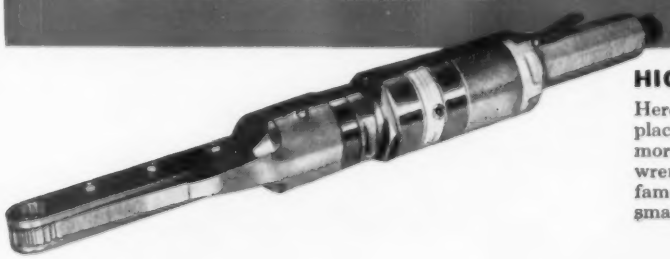
ONE TOOL—TWO JOBS

This versatile Gardner-Denver multiple nut setter adjusts to the bolt pattern of two different models. One operation tightens all nuts simultaneously—each to predetermined torque. Standard handles and spindles assembled on mounting plate designed to handle any bolt pattern. Operating at show.

NO TORQUE REACTION

Here's the Gardner-Denver 16C-5 angle nut setter that not only reaches around corners and into channels, but accurately senses specified torque. It's equipped with an angle version of the popular "Safe-Torque"* clutch. Powerful, muffled air motor.

*Licensed Trade-Mark of Scully-Jones & Company



HIGH-CAPACITY RATCHET WRENCH

Here's your solution to large nuts in awkward places. It handles high torque to 125 ft.-lb. or more. Yet, this Gardner-Denver 17B-515 ratchet wrench has the versatility and durability of the famous Gardner-Denver ratchet wrenches in smaller sizes. Operating at show.

DENVER air tool versatility and interchangeability

LEARN FULL DETAILS AT THE TOOL SHOW IN DETROIT

BOOTH NO. 1827

Exhibit . . . PLUS

NEW REVERSIBLE TOOLS

To solve small-capacity fastening applications, Gardner-Denver introduces a new line of No. 1 motor reversible tools. Screw drivers and nut setters are available with suction pickup feature, plus a variety of clutches and angle attachments. Operating at show.

A Gardner-Denver production machine setup which includes the "Tru-Thread" Tapper and the new 92D-2 "Airfeedrill"® on the same automatic machine. Operating at show.

Pedestal-mounted compression riveter. Operating at show.

Air hoist and "Hoistractor" combination that combines lifting power and push-pull power. Operating at show.

Packaged WB air compressor will be in operation at our booth. Note how it cuts foundation requirements . . . how easily and quickly it can be installed in your plant.

Cutaway models of rotary air motor and piston air motor hoists.

Other "Airfeedrill" models. Two sizes.

Other "Tru-Thread" Tappers. Two sizes.

Multiple spindles, centered and offset. Three sizes each.

"K-Matic"® drills for hard metals.

Our new No. 3 and No. 5 air tool lines.

Our No. 1 and No. 2 air tool lines.

Ratchet wrenches. Four sizes.

Impact wrenches. Five sizes.

Abrasive air tools—saws, files, grinders.

Percussion air tools—riveters, scalers, hammers.

Mountable air motors. Six sizes.

Air tool accessories—balancers, filters, regulators, lubricators.

GARDNER-DENVER Since 1859

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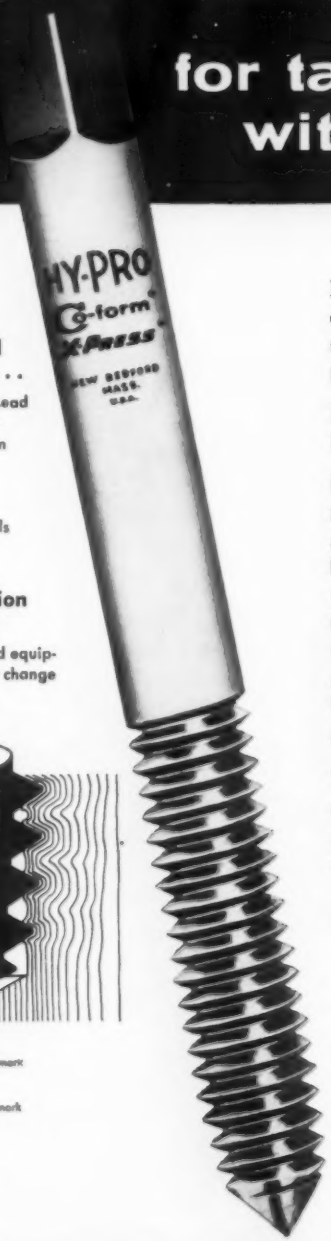
HY-PRO

Co-form® X-PRESS® TAPS

Manufactured under license from Besly-Welles Corporation

for tapping threads without cutting



Recommended for tapping . . .

Copper Brass Lead
Aluminum Zinc
Steel Magnesium
Die Castings
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Stainless Steel
— other ductile metals

Tapping operation is the same

Conventional methods and equipment are used, except for change to larger tap drill sizes.

Co-form is a registered trademark of Hy-Pro Tool Company.

X-Press is a registered trademark of Besly-Welles Corporation.

HY-PRO

NOW — from HY-PRO you can get the newest in tap design — Co-form X-Press fluteless taps that are setting cost-reduction records on many jobs that were formerly "tap-killers".

HY-PRO Co-form X-Press taps cold-form threads in through or blind holes, with these advantages . . .

No Chips to clog and cause tap breakage — no chip removal problems • **Permit Faster Tapping Speed** and boost production from automatic equipment **Provide Accurate Control** of hole size — cannot be forced into lead error • **Eliminate Blind Hole Tapping Problems** — no chips to jam at bottom • **Form Stronger Threads** with better holding power • **Taps Are Stronger** without flutes, especially in smaller sizes **Taps Last Longer** and maintain accurate size tolerance **More Holes Per Tap** — up to 40 times greater tap life.

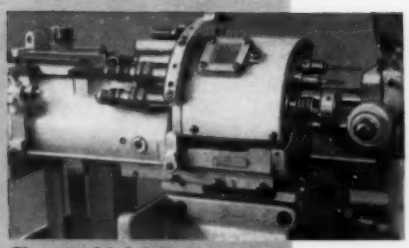
Try HY-PRO Co-form X-Press taps on your toughest tapping operations. For complete application information, call your HY-PRO Distributor or write: HY-PRO Tool Co., Dept. C, New Bedford, Mass.

Tap for less with Co-form® X-Press®

For the complete line of HY-PRO standard taps from stock, call your local HY-PRO Distributor.

HY-PRO TOOL COMPANY

NEW BEDFORD, MASS., U. S. A.



Close-up of 3 Spindle Universal Attachment shows drill in first position, tap in second position, die head in third.

New 3 Spindle Universal Attachment for BECHLER SWISS AUTOMATICS

To be Demonstrated at A.S.T.E. Show, Booth 350

We are proud to introduce the new 3 Spindle Universal Attachment, available with the widely accepted AR Base. With it, you eliminate secondary operations... increase end-operation accuracy . . . cut production time and costs . . . do Centering, Drilling with stationary or revolving spindles, Reaming, left or right hand Threading and Tapping, Milling, Slotting, Recessing and Undercutting.

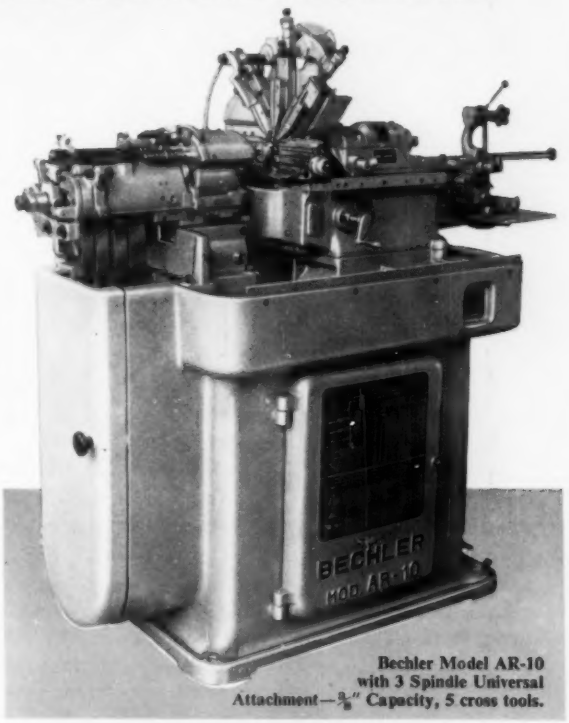
OUTSTANDING FEATURES

- Horizontal Mounting Seat allows longitudinal adjustment to fit workpiece length
- Large chip clearance
- Increased Spindle Stroke
- Increased Spindle clearance for larger tool holders
- Heavier Spindles for greater rigidity
- Universal Spindles permit any operation at any position
- Positive Position Locking for more accurate alignment
- Increased threading capacity with self-opening die heads using Headstock Spindle Brake
- Front milling—(slotting) using headstock spindle brake

Additional accessories for Bechler Swiss Automatics include: Camshaft Accelerator, Headstock Spindle Brake, Spindle Indexing device. Attachments for slotting and back-drilling, cross drilling and milling.

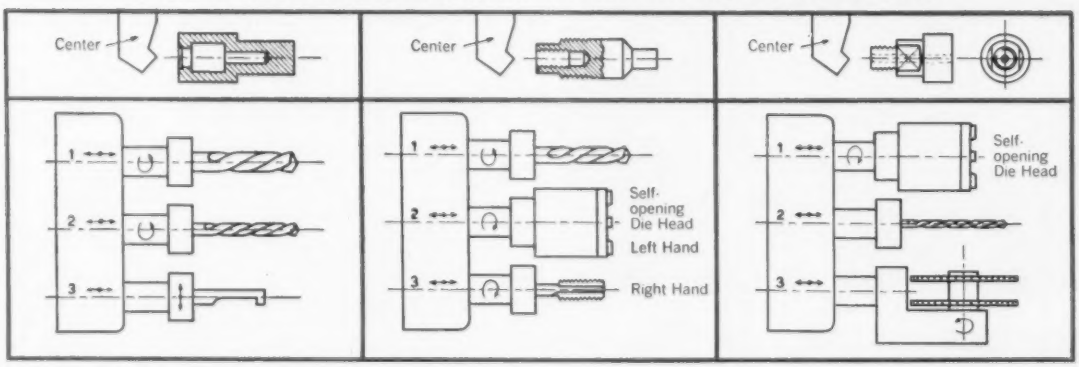
Bechler Swiss Automatics are available with barstock capacities up to 1¼"... turning length to 9".

Write today for further information



Bechler Model AR-10 with 3 Spindle Universal Attachment—⅝" Capacity, 5 cross tools.

THREE POSSIBILITIES IN WIDE VARIETY OF TOOLING SET-UPS



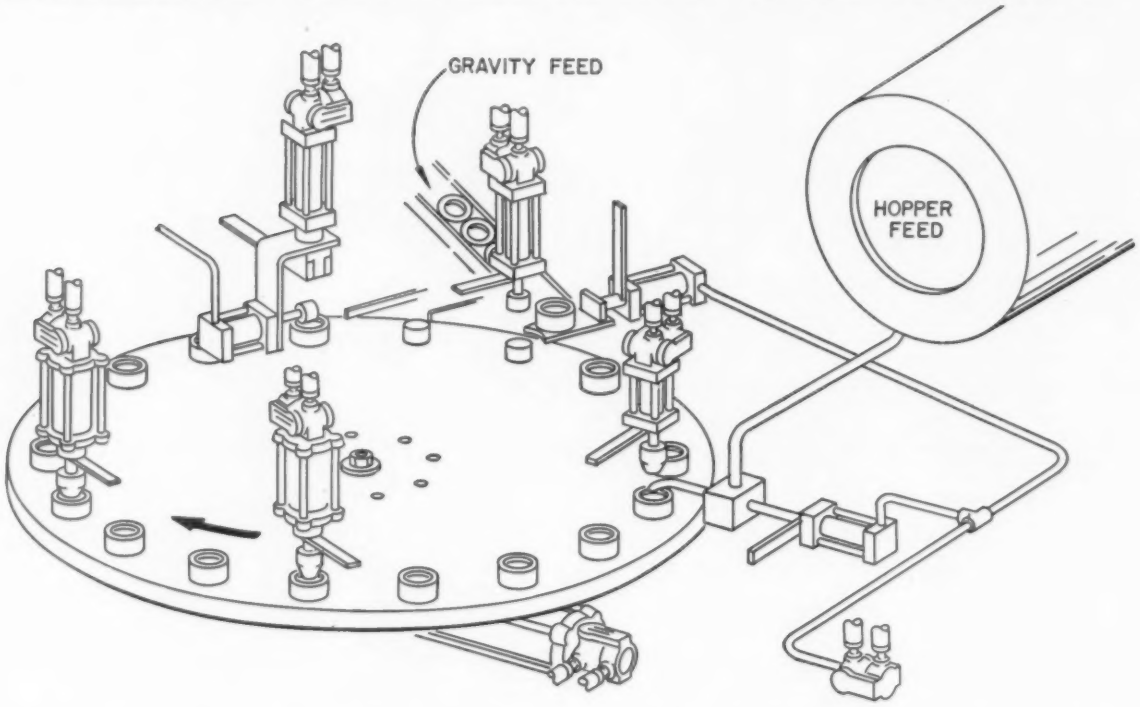
BECHLER

Swiss Automatics and Allied Precision Equipment

AMERICAN BECHLER CORPORATION

28 HARBOR STREET, STAMFORD, CONNECTICUT

THIS BELLOWS "SPOT-A-MATION IDEA" SAVED $82,754.00



Engineers at the Naval Ordnance Plant, Macon, Georgia, were given the assignment to "effect major production economies" in the assembling of explosive components for ordnance use. The operations were being performed manually by 33 people. The engineers designed and built two automatic assembly machines, each using a Bellows Rotary Index Table and five explosion-proof Bellows Air Motors. The savings on direct labor costs alone on one contract amounted to .0109 man-hours per assembled part for a total dollar savings of $82,754.00.

This same basic idea can be readily adapted to handle an almost unlimited range of small parts assembly procedure: staking, crimping, screw or stud placement, welding partial or complete small assemblies, etc.

It is typical of the many ways ingenious engineers "spot-automate" costly and troublesome production centers with Bellows "Controlled-Air-Power" Devices.

Chances are that many such opportunities exist in your plant. Why not investigate today?

Air Force Photo by Robins AF Base, Ga.

The savings of $82,754.00 made through these automatic assembly units are based on direct labor costs and are exclusive of any possible savings from reduced overhead. In addition, 1000 sq. ft. of floor space was released for other operations.

SEE THIS SPOT-A-MATION IDEA IN ACTION

BOOTH 1109 • ASTE SHOW

Be sure to see the basic Spot-A-Mation Idea shown above, together with other cost-cutting ideas, on display in the Bellows-Valvair booth at the Tool Show, Detroit, April 21-28.

14928-3

The Bellows Co.

DIVISION OF INTERNATIONAL BASIC ECONOMY CORPORATION (IBEC)

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Ever visit this tooling "trophy" room?

Hundreds of production executives concerned with close-tolerance tooling for both civilian and military needs have visited this Ehrhardt "Trophy" room.

If *you* haven't, come soon. For here you may find the answer to your own tooling problem—*any* tooling problem requiring high-precision dies, gages, jigs, fixtures or special machinery.

In this room we display strips of sample runs of stampings from the precision dies we produce for leading manufacturers of electrical, appliance, automotive, ordnance and other industries.

These stampings represent solutions achieved during the last two decades by the best-manned, best-equipped tool-making facility on the Mississippi!

To be specific: the eight men on the Ehrhardt/St. Louis Planning Committee represent 200 years of America's finest tool-and-die-making experience. The 60 highly skilled and thoroughly experienced craftsmen, many of whom were trained at Ehrhardt, produce their close-tolerance work on late-type equipment only.

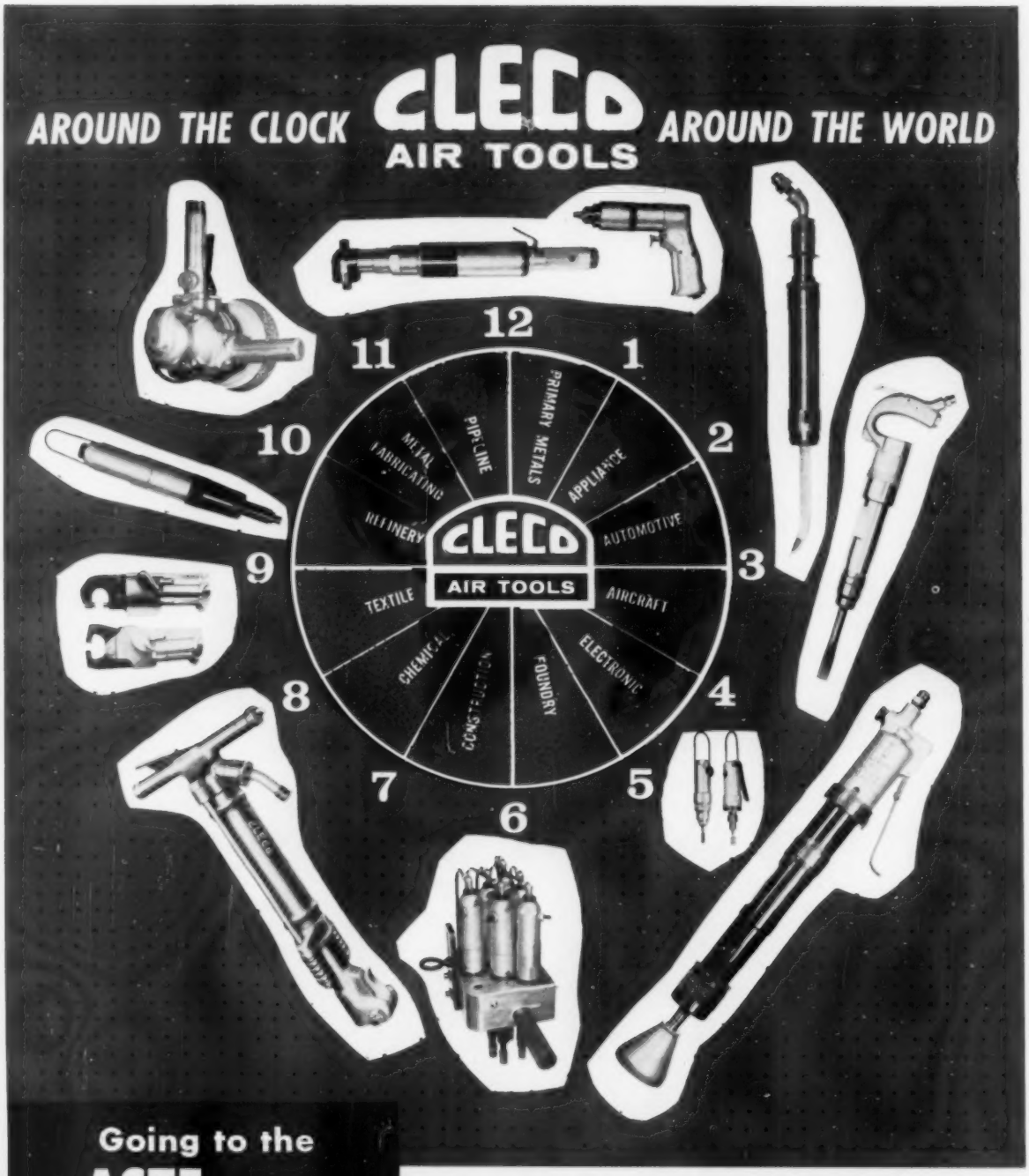
So plan to see the Ehrhardt "Trophy" room at your first opportunity. Talk shop with our tooling specialists. And right now while you think of it, write for a copy of TRIPLE PLUS (the three plusses: Precision Skills, Full-range Facilities, Unique Experience).

This 24-page illustrated brochure will show you how Ehrhardt can produce exactly the close-tolerance work you need—from a gage to a complete tooling program. And save you time and money.

Ehrhardt Tool & Machine Company
914 Monroe Street, St. Louis 6, Mo.

"A Nation-wide Service to the few who want the most in high precision gages, dies and fixtures."

Ed Deuser, Ehrhardt shop foreman, left, and Ed Humm, shop superintendent, draw on many years of experience in solving tooling problems. Talk to them about yours.



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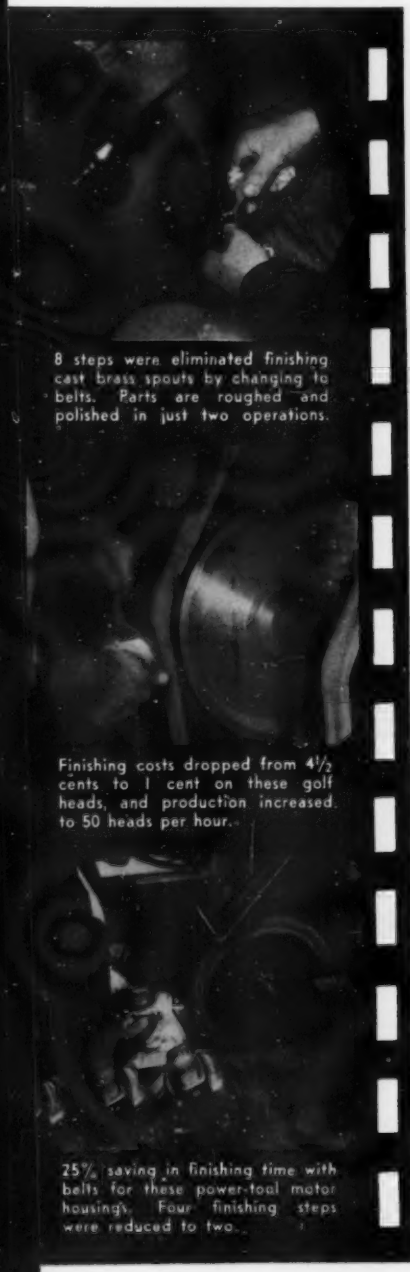

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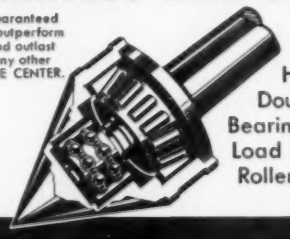

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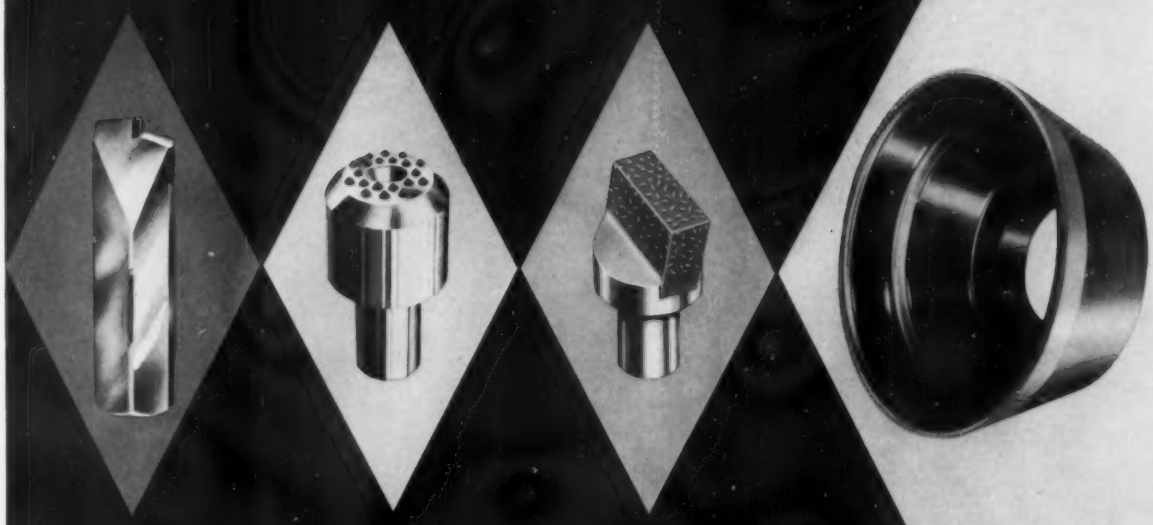

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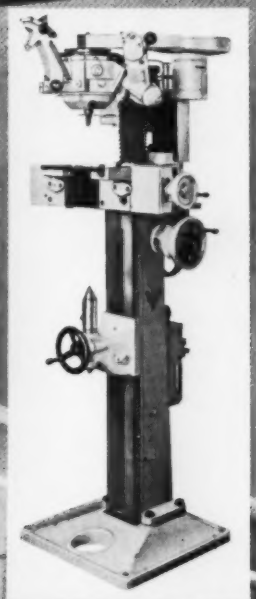

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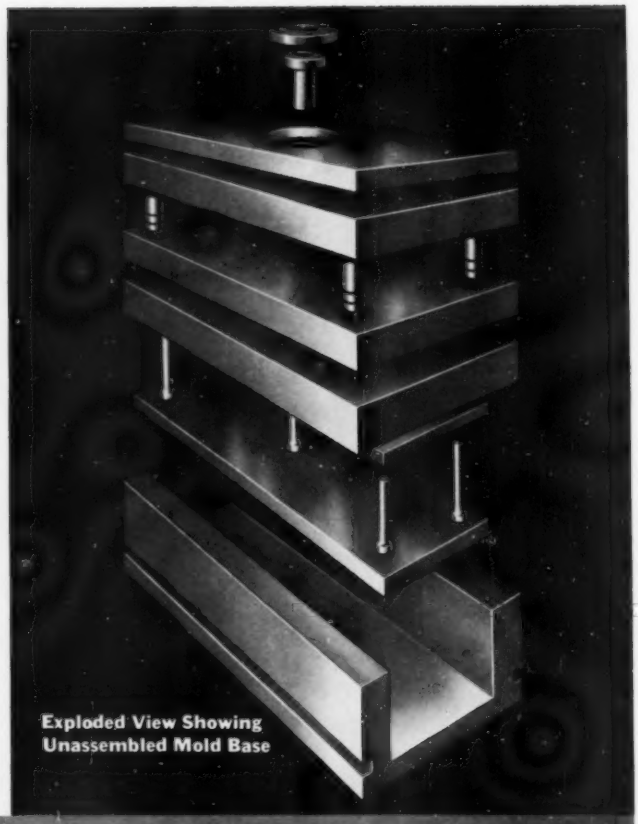

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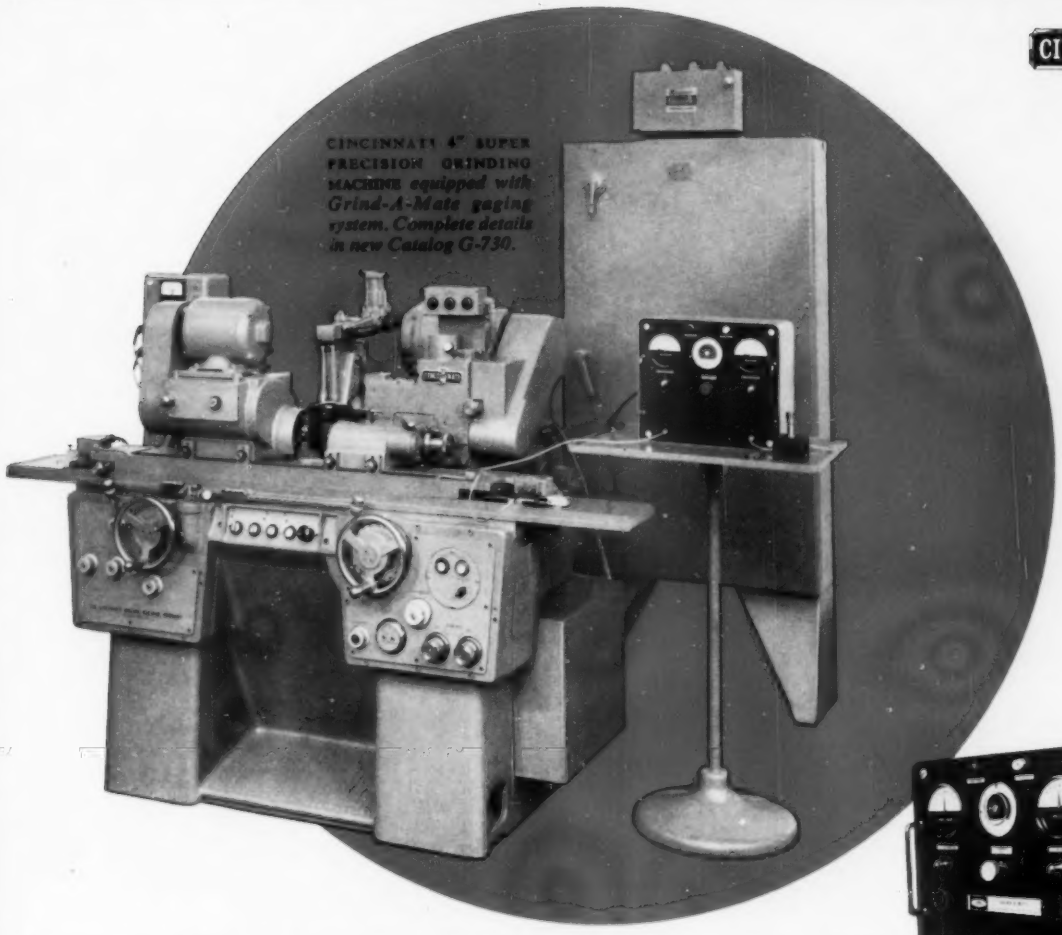

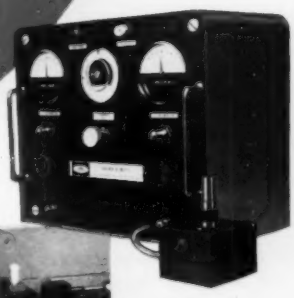

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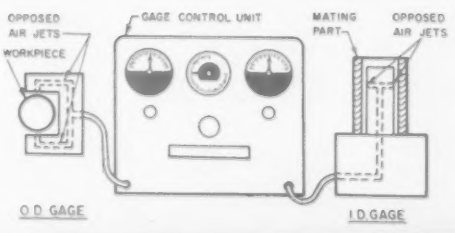

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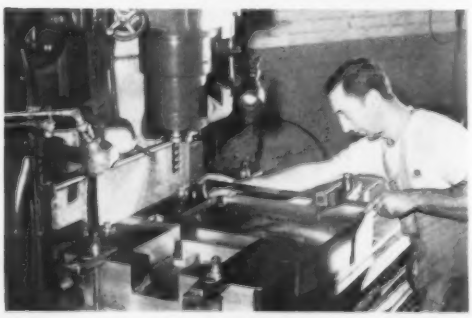

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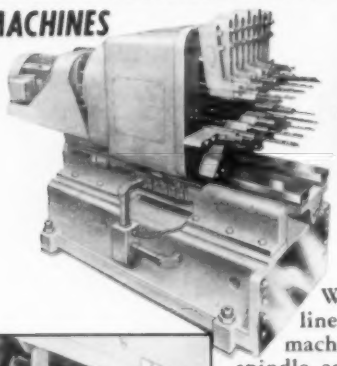

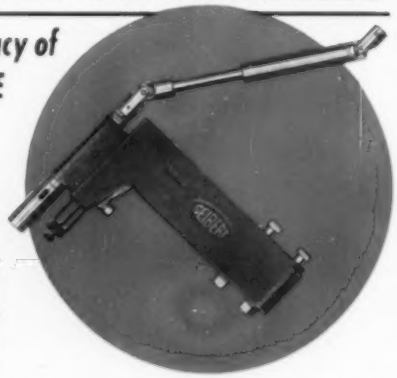

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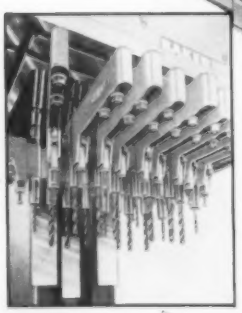

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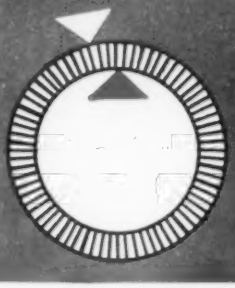

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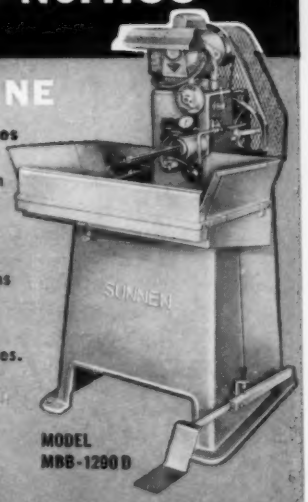

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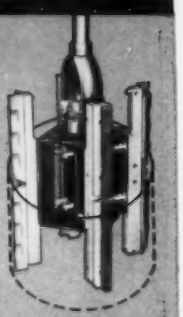

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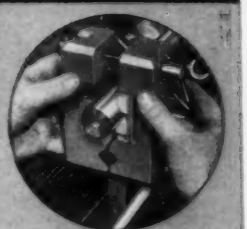

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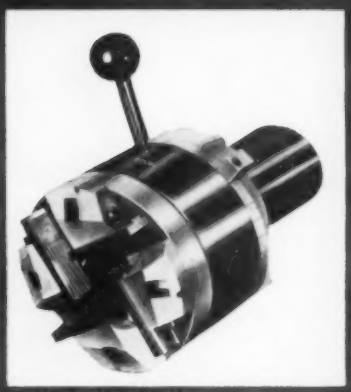

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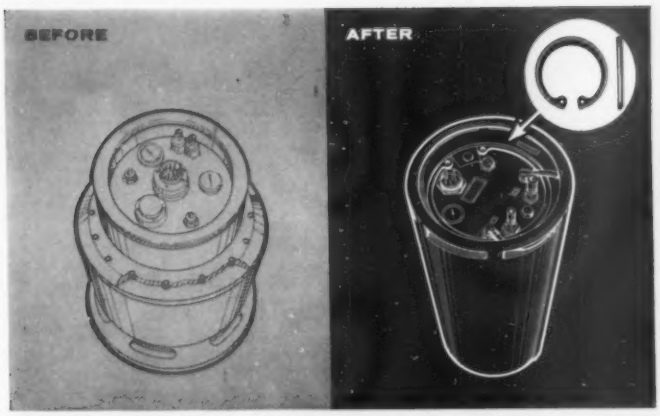
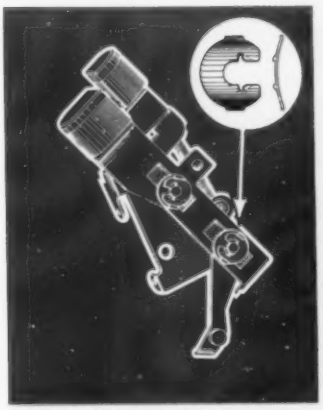
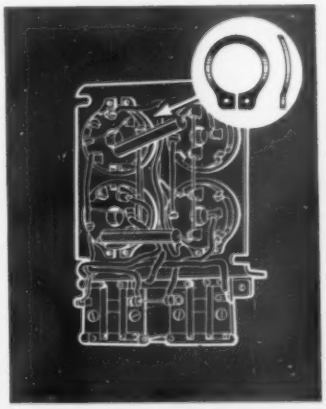


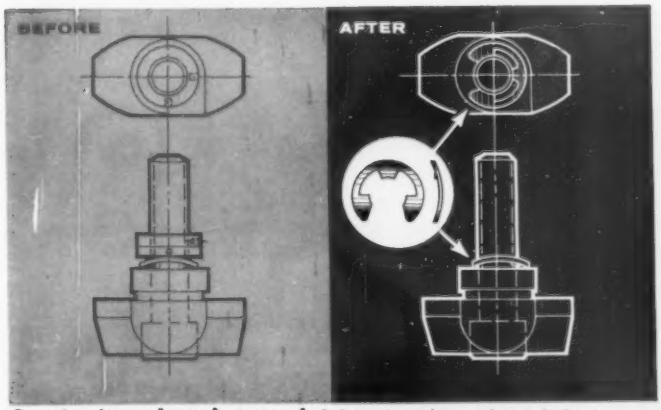
Pressure cover design simplified. Two axially assembled Truarc Series 5002 beveled rings eliminate 27 bolts, reduce machining and assembly time from 78 to 1½ hours and make possible drastic size and weight reductions. Rings retain two covers of a pressurized x-ray unit. **Savings: about $500 per unit.**



Parts eliminated in slide assembly. Two radially assembled Truarc Series 5139 Prong-Lock® Rings provide proper spring tension, eliminate looseness and wobble in this office calculator shift-slide. Original design called for a cut washer, spring washer, and cotter pin—all eliminated.



New way to install electron-tube sockets. Easy-to-apply Truarc Series 5101 bowed external rings lock tube sockets to chassis plate in this assembly. Bowed construction takes up tolerances of molded grooves, thickness of base. Individual sockets are removable for field service.



Quarter-turn clamp improved. A bowed washer and two locknuts were eliminated in this quarter-turn jig-and-fixture clamp by a Truarc Series 5131 bowed E-ring. The radially assembled ring holds the screw captive, provides required rotational drag between parts with sufficient tension to insure tight fit when the screw is first engaged. **Typical savings: $1.35/unit—assembly up 70%.**

Truarc rings for end-play take-up offer significant design advantages

A number of Truarc retaining rings are available to take up end-play or loose fit caused by accumulated tolerances and wear. The rings often eliminate spring washers, collars and set screws, nuts, bolts, rivets, cotter pins and other conventional fastening devices with outstanding cost savings in machining and assembly time.

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In beveled rings for rigid end-play take-up, the groove-engaging edge is beveled at 15°. There is a corresponding bevel on the load-bearing groove wall. To take up end-play, the ring acts as a wedge between the outer groove wall and the part being retained.

These are just a few of the 50 functionally different types of Truarc retaining rings. They come in up to 97 standard sizes, six metal specifications, 13 different finishes. The entire line as well as accessory assembly tools, grooving tools, and over 70 typical applications are shown in the new catalog RR 10-58. Write for your copy today. And remember Waldes Truarc engineers are always ready to work with you on your specific projects. Waldes Kohinoor, Inc., 47-16 Austel Place, Long Island City 1, N.Y.

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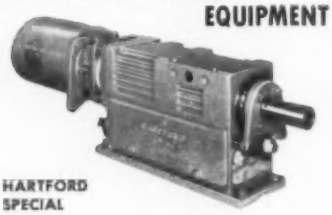

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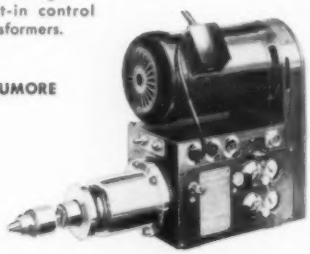

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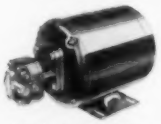

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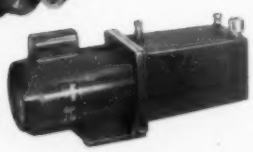

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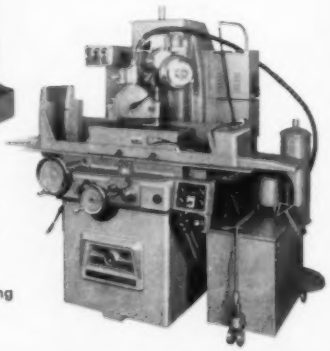

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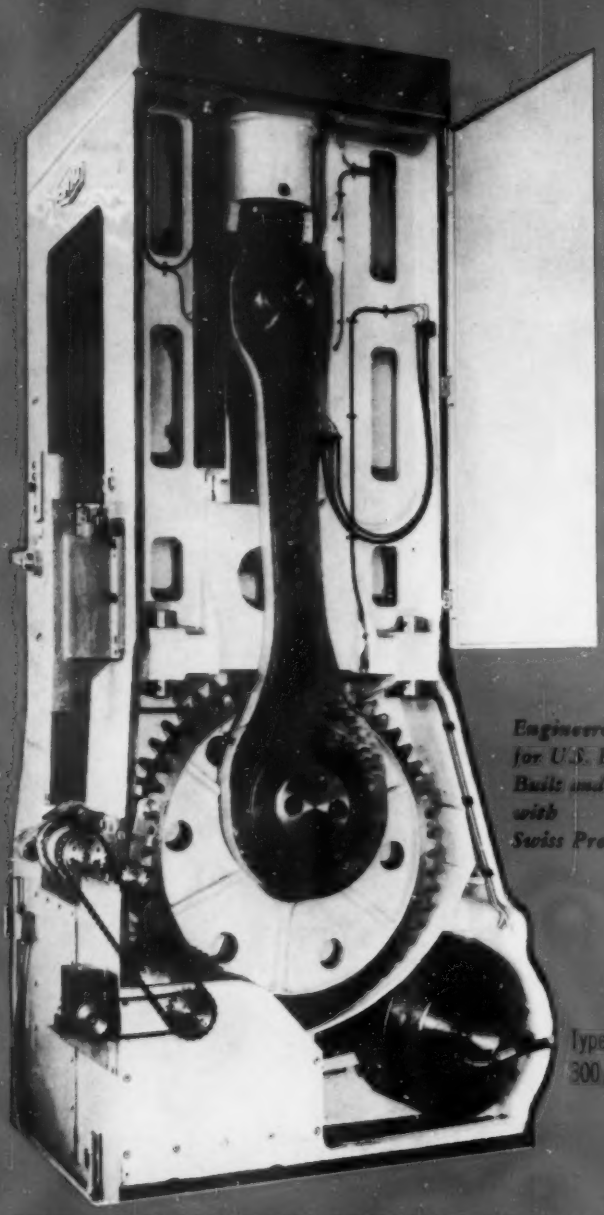

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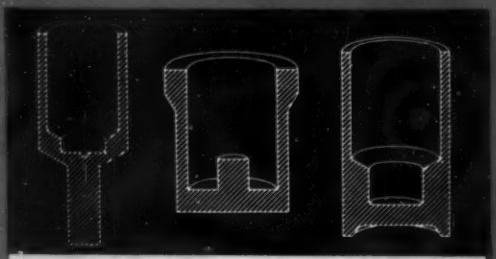

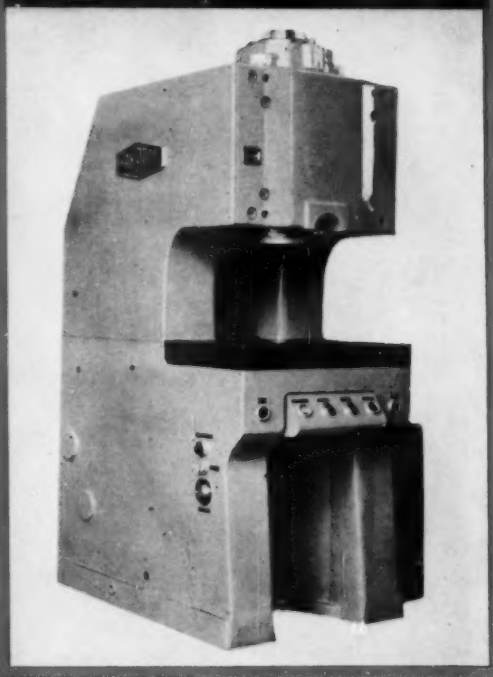

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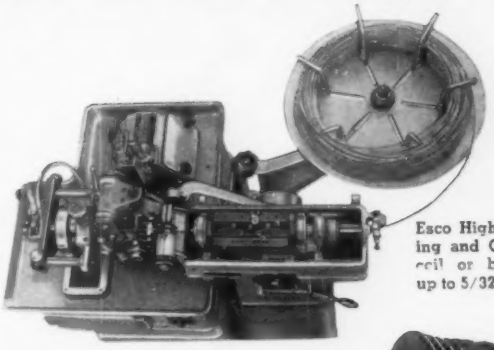

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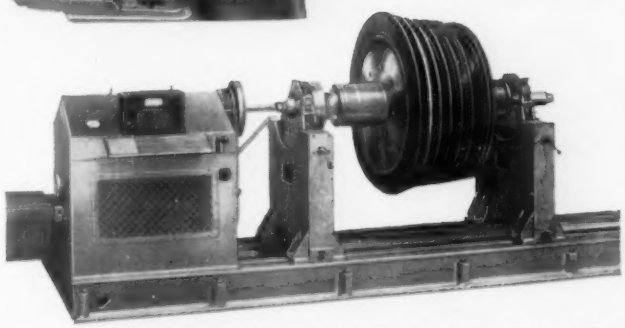

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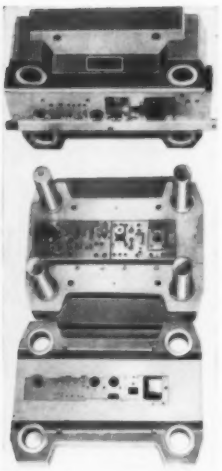

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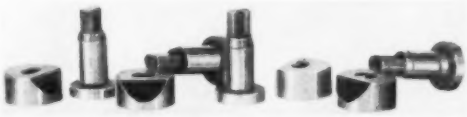

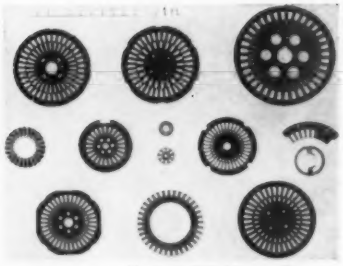

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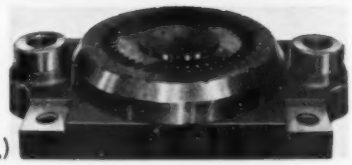

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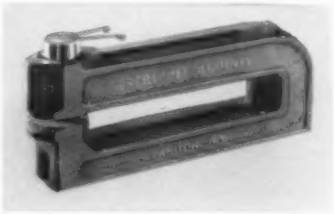

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308	323	338	353	368	383
309	324	339	354	369	384
310	325	340	355	370	385
311	326	341	356	371	386
312	327	342	357	372	387
313	328	343	358	373	388
314	329	344	359	374	389
315	330	345	360	375	390

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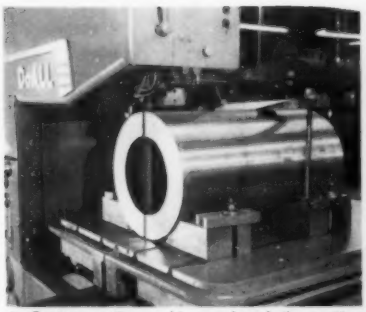
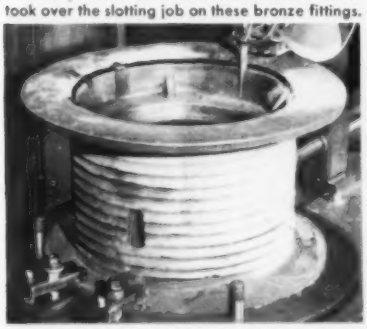
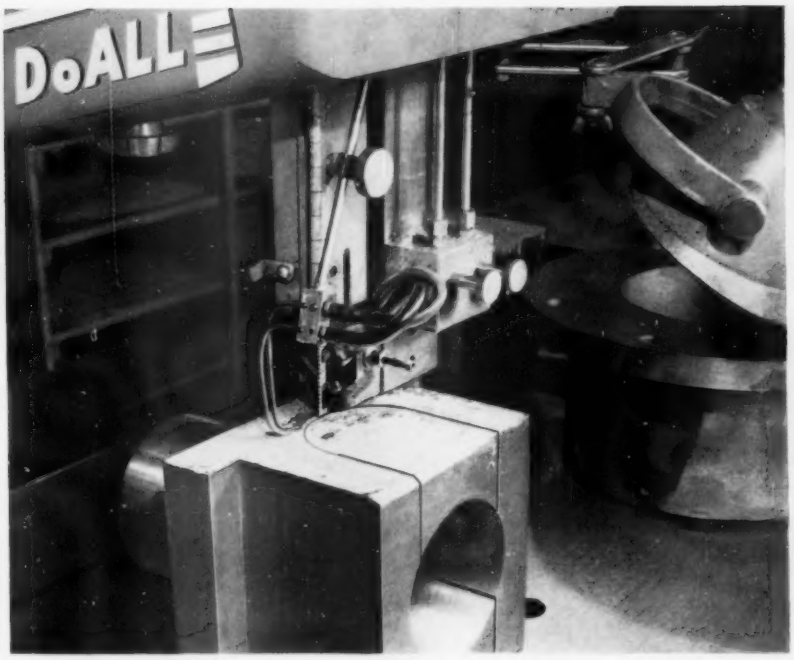


A Contour-matic machine reduced the cutting time on these chrome steel bushings 75 per cent.

Production time dropped 58 per cent and setup time 66 per cent when a Contour-matic machine took over the slotting job on these bronze fittings.



A Contour-matic machine saved 38 per cent in splitting time on this large dragline lagging. Below: heavy-wall cable housings shaped at a saving of 66 per cent on a long production run.



VALUE ANALYSIS WILL PROVE UNBELIEVABLE SAVINGS WITH VERSATILE Contour-matic® BAND MACHINES

Contour-matic band machines are achieving spectacular savings in tooling costs, time and material on hundreds of mass-production and job-lot runs today. These versatile machines make internal and external cuts 4 to 8 times faster than conventional machines, and with greater accuracy, better finish.

For example, in the above illustration a Contour-matic machine made both straight and contour cuts in this large welding machine part. First the sides were shanked. Then the center section was removed with a radius at the bottom. Other time-slashing applications are shown at the left. These are typical examples of how DoALL is helping step up productivity with its new Contour-matic band machines. The time saved can be used to save still more time on other jobs—on almost limitless applications.

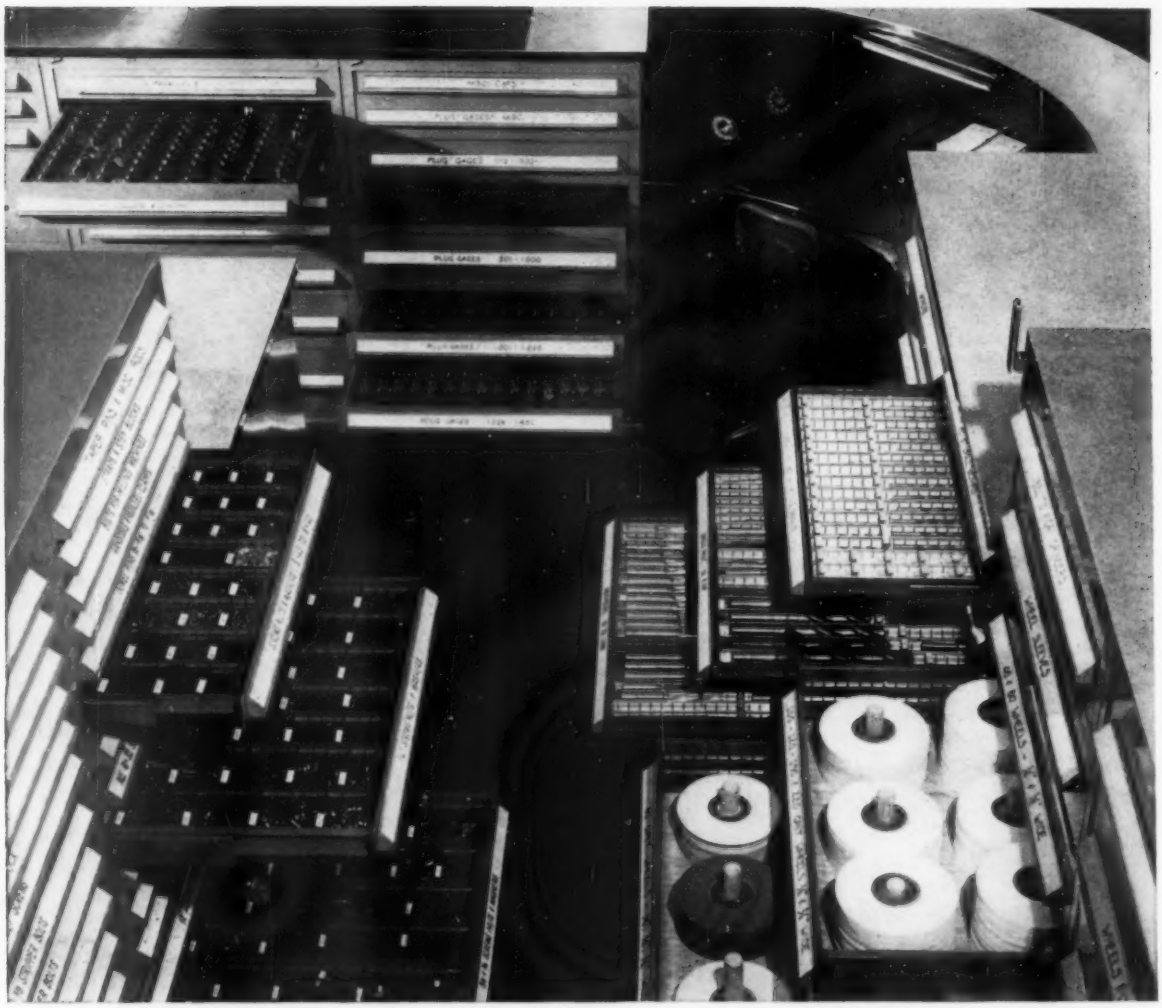
Let a DoALL sales engineer show you how you can expand the range of your work, increase production and boost profits with Contour-matic band machines. He gladly will arrange an in-plant demonstration—no obligation. Four models, 4 throat sizes: 16, 26, 36, and 60 in. Call your local DoALL store today.

See the DoALL Exhibit in Booth 1226, ASTE Tool Show

8-61

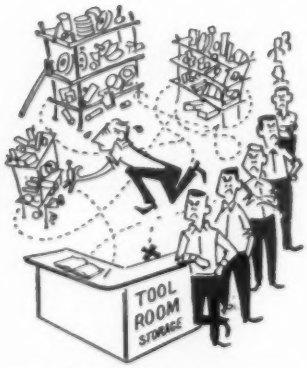
This is a typical DoALL Store

The DoALL Company, Des Plaines, Illinois



This storage space makes money

SEE HOW at Booth 547, A.S.T.E. Show!



THIS ONE DOESN'T. *Outdated storage—disjointed, harum-scarum—keeps skilled workers waiting needlessly. Everything hard to see, hard to find, hard to keep track of.*

HOW? By putting more spare parts, tools, gages, fixtures, assemblies and components into a given area than could possibly be fitted into outdated tool cribs or storage bins. And by keeping them close at hand, fully visible...absolutely safe from damage, loss, dust or pilferage.

Vidmar industrial storage units are of heavy gauge steel. Cabinets come in various heights, and so do drawers—which can be partitioned in unlimited arrangements. Drawers are strong, holding up to 400 lbs. each! All units are modular...can be moved, interchanged, re-arranged, and added-to as required from year to year.

BEFORE YOU revise or add to your storage facilities, it will pay you to check Vidmar industrial storage units. Write today for descriptive literature. VIDMAR, INC., 2328 Reach Road, Williamsport, Pa.

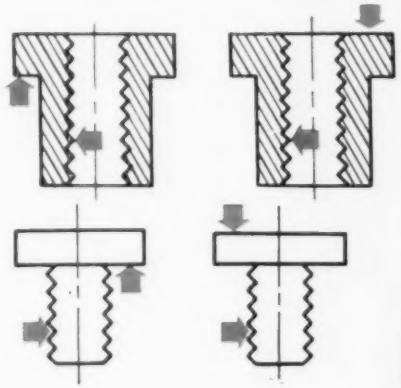
Store more...better...in less space with

Vidmar CABINETS

Division of VOLKERT STAMPINGS, INC.

USING OR PRODUCING small THREADED PARTS?

Check Squareness of Face Fast, Easily, Accurately!



NEW BRYANT ATTACHMENT CHECKS PARTS UNDER 2″ DIAMETER . . .

Now, with one easy-to-use attachment, you can double the versatility of your present Bryant Bench Gages at minimum cost.

Mounted on the workholder post of the B-21 Bench Gage, the 9104-B Squareness of Face Attachment quickly checks true face run-out in relation to thread axis on parts with face diameters measuring 0 to 2″.

If you take pride in your quality control, complement your other fine inspection equipment with this new Attachment. You get famous Bryant precision, plus these cost-saving features:

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- Checks narrow and hard-to reach faces
- Accurate check regardless of thread tolerance
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- Contact points adjustable to 2″
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FREE—Send today for the complete fact-story on the Bryant B-21 Bench Gage. See how it checks parts with internal and external threads to 5″ dia., parts with special grooves, snap ring or O-ring grooves, and checks face squareness and concentricity of diameters—and does it 8 to 10 times faster!

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TYPICAL PERFORMANCE OF KENNAMETAL K165

Work Material	Operation	Tool	Depth of Cut	Speed sfm	Feed ipr	Performance
Arma Steel 88M, 32 RC	Finish facing 50 rms max. finish	KSBL-16C SPG-422	.021"	775	.0024	77 pieces per index with 20-30 rms finish. Best performance other tool material: 20 pieces per index with 40-60 rms finish.
AISI 308 Stainless Steel Tubing	Finish turn tracer lathe	KTGR-20C with TPG-433	.020" to .093"	950	.010	Negligible tool wear. 50 rms finish. .0001" loss of size in 41" cut. Old tool material: .030" flank wear, unacceptable finish, and .005" loss of size.
Cast Iron	Finish turning	Special TNG-321	.020"	1260	.009	Best performance of any other cutting materials evaluated.
M2 HSS Forging	Finish turning	KSFR-16 SNG-422	.100"	585	.016	11 pieces produced with less than .005" wear land. Previous tool material: 6 pieces at considerably lower machining conditions.
304 Stainless Steel	Precision boring	Precision boring tools	.0075"	1500	.003	6 holes, 5" deep, resulted in only .0002" loss of size and a surface finish of 10 rms.
Tricent Cylinder Case, 44.3" dia. x 23" long, 46 RC	Finish turn	KTDR-16C TPG-322	.005"	480	.007	40-60 rms finish. No measurable taper or tool wear. Previous tool material: extreme difficulty in obtaining 125 rms finish; unacceptable taper required additional passes and severe steps.

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April 21
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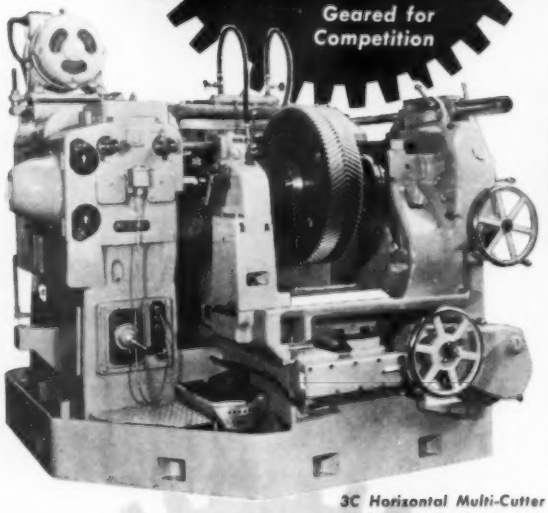

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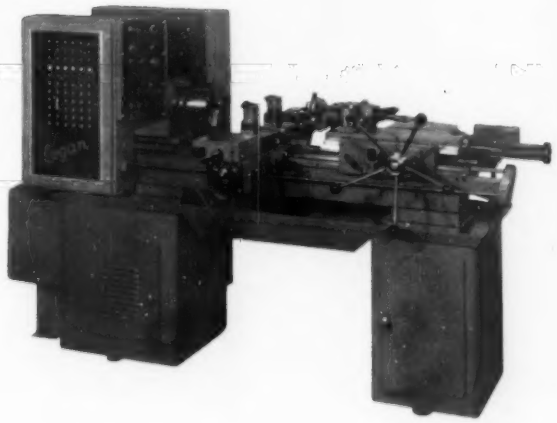

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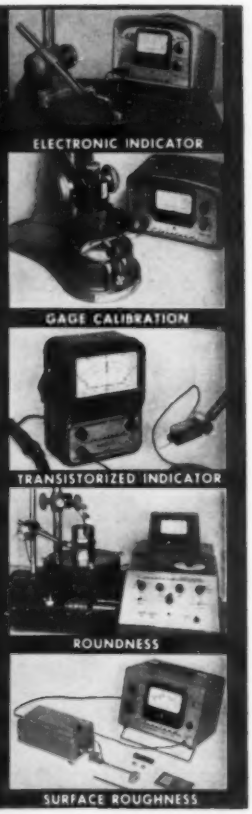

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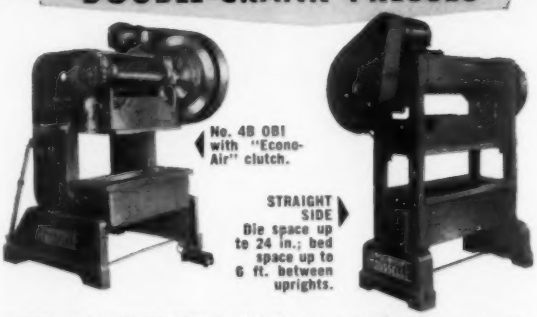

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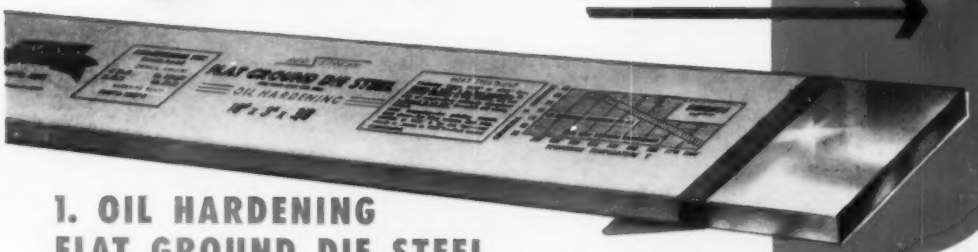

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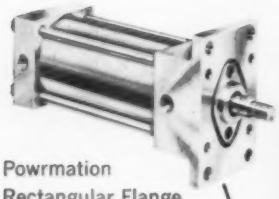

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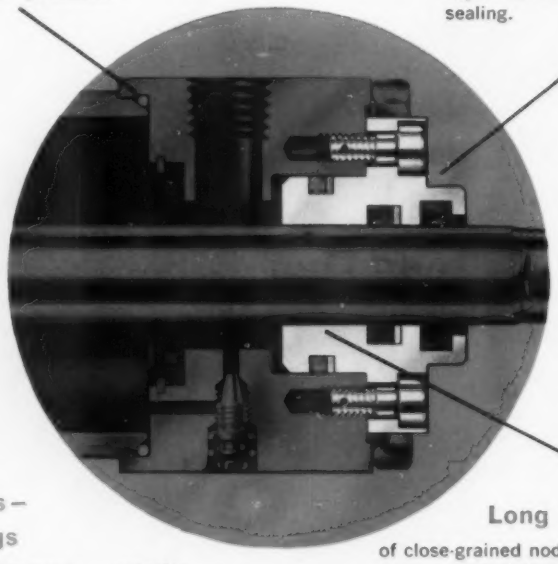
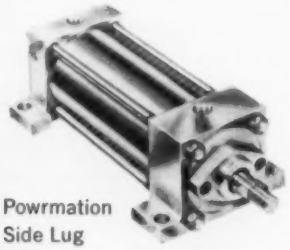
Rod End





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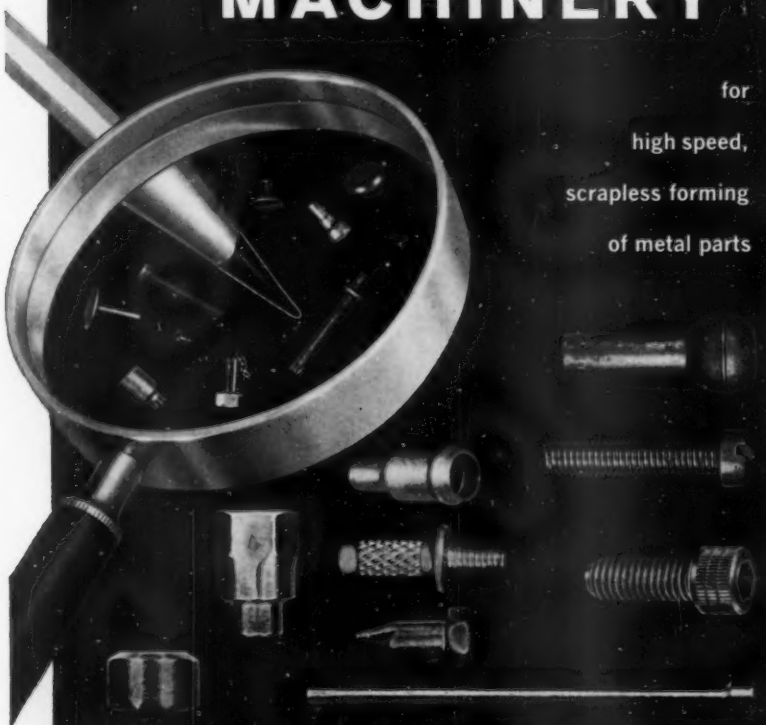

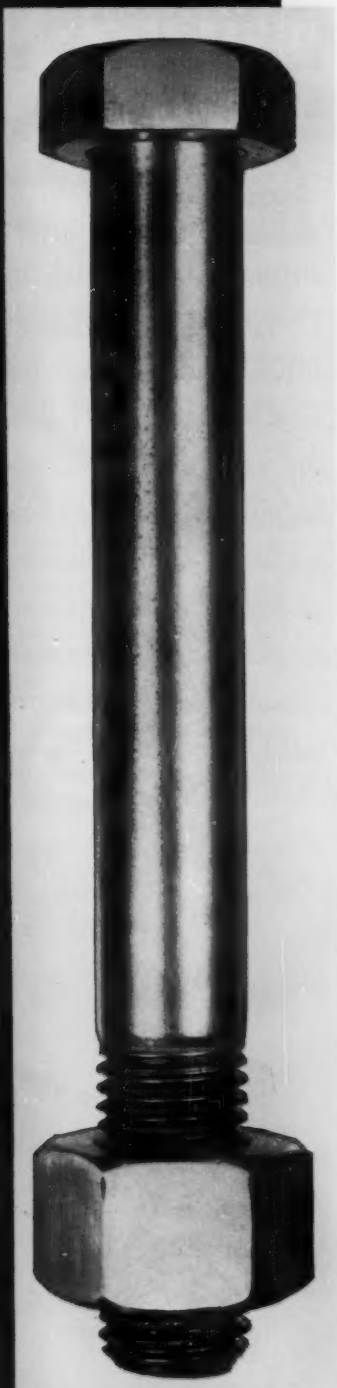

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Stubbing drills in preset holders increases productivity

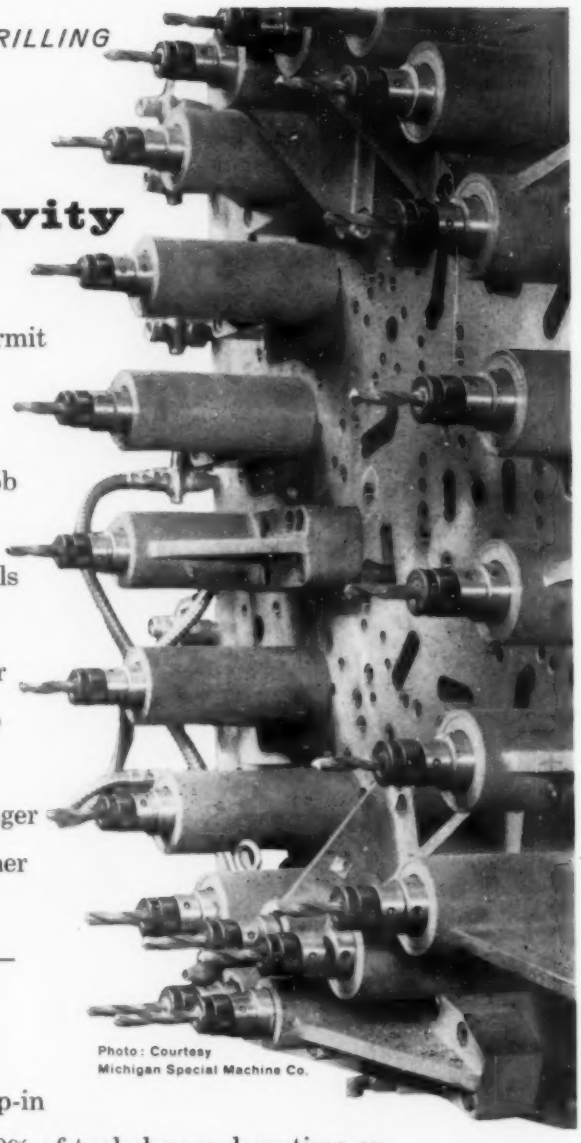


Photo: Courtesy Michigan Special Machine Co.

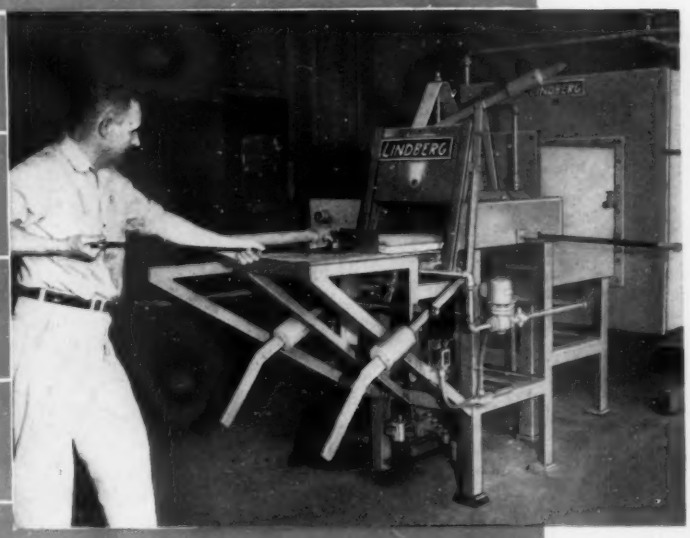
SCULLY JONES "Stub-A-Long" chucks on this multiple-spindle drilling head permit setting tools accurately outside the machine. They avoid hours of downtime for routine adjustments. A simple height gage does the job for a lot less money. But this is only one way they reduce costs. Note how the tools are stubbed up in the holders. Long drills are like torsion springs, with torsional twist or vibration on the cutting edges proportional to projection. Stubbing makes them stiffer—reduces chatter and saves drills. Result is longer tool life, increased production. Add still another advantage. Short rigid drills cut straight without bushings. This eliminates "rubbing"—a cause of drill wear overlooked by many people. "Stub-A-Long" chucks are available with quick-ball-lock collars, the snap-in holders that eliminate 80% of tool-change downtime on multiple-spindle machines. Your Scully-Jones representative or distributor can show you other tooling ideas that increase machine utilization. Phone him or write for literature.

MAXIMUM MACHINE UTILIZATION

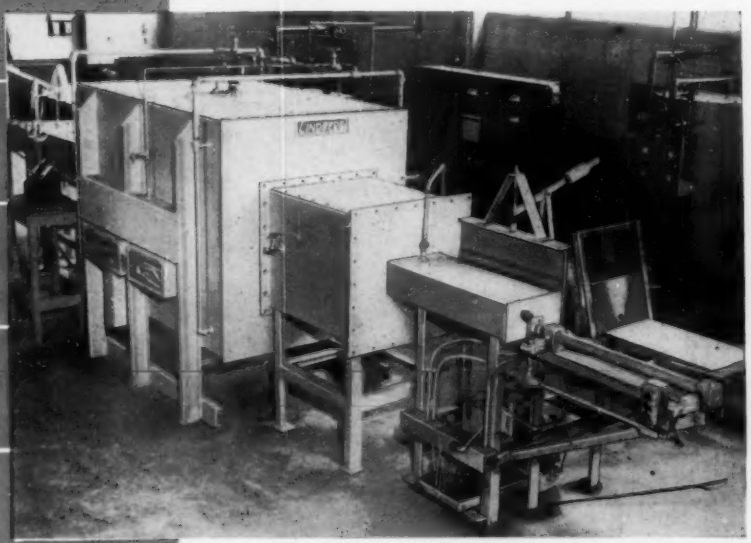
Scully-Jones and Company 1915 South Rockwell Street, Chicago 8, Illinois

NEW LINDBERG FURNACE PROVIDES IMPROVED EFFICIENCY FOR STAINLESS STEEL SINTERING

This Molybdenum Element Atmosphere Pusher Type Furnace embodies high temperature refractories suitable for low dew point without muffle



This new furnace provides an improved method for sintering stainless steel compacts in hydrogen or dissociated ammonia. A development of Lindberg's engineering staff, you can depend on the most efficient, economical and trouble-free service from it. Furnace provides side loading and discharge parts with purging chambers. Work trays, ceramic slabs or molybdenum boats, move through the furnace by hydraulic pusher. In the installation illustrated below ammonia dissociator and control panels are shown at the right. Hydrogen supply cylinders are located outside the building. For full information on this and Lindberg's complete line of sintering and brazing furnaces just get in touch with your local Lindberg Field Representative (see classified phone book) or write us direct. Lindberg Engineering Company, 2447 West Hubbard Street, Chicago 12, Illinois.



Type MOP-1207-A8C Molybdenum Element Atmosphere Pusher Furnace. Maximum Temperature 2000° F. 60 KW input. 12" wide, 30" long, 7" high. 60" cooling chamber, 36" long preheat chamber.

LINDBERG heat for industry

It's new....

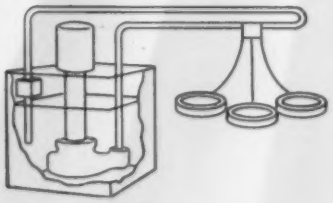
It's here...

It's the NEW LAPMASTER

FEATURING:

√Automatic Control of Lap Plate Flatness

√New Abrasive Distribution System



The completely new Lapmaster gives you automatic lap plate flatness control . . . PLUS . . . the ultimate in abrasive handling efficiency with a brand new compound distribution system . . . new, compact design . . . larger, wrap around work table to facilitate loading and unloading.

Automatic sensing head detects errors in lap plate flatness within one light band . . . automatically shifts conditioning rings to compensate . . . assures absolutely uniform lapped surfaces from the first piece to the last, without operators' attention and . . . eliminates human error and rejects.

New abrasive dispensing system keeps mixture of lapping compound and vehicle consistent . . . assures uniform distribution . . . equal rate of stock removal of all parts . . . adjustable flow control . . . no clogging.

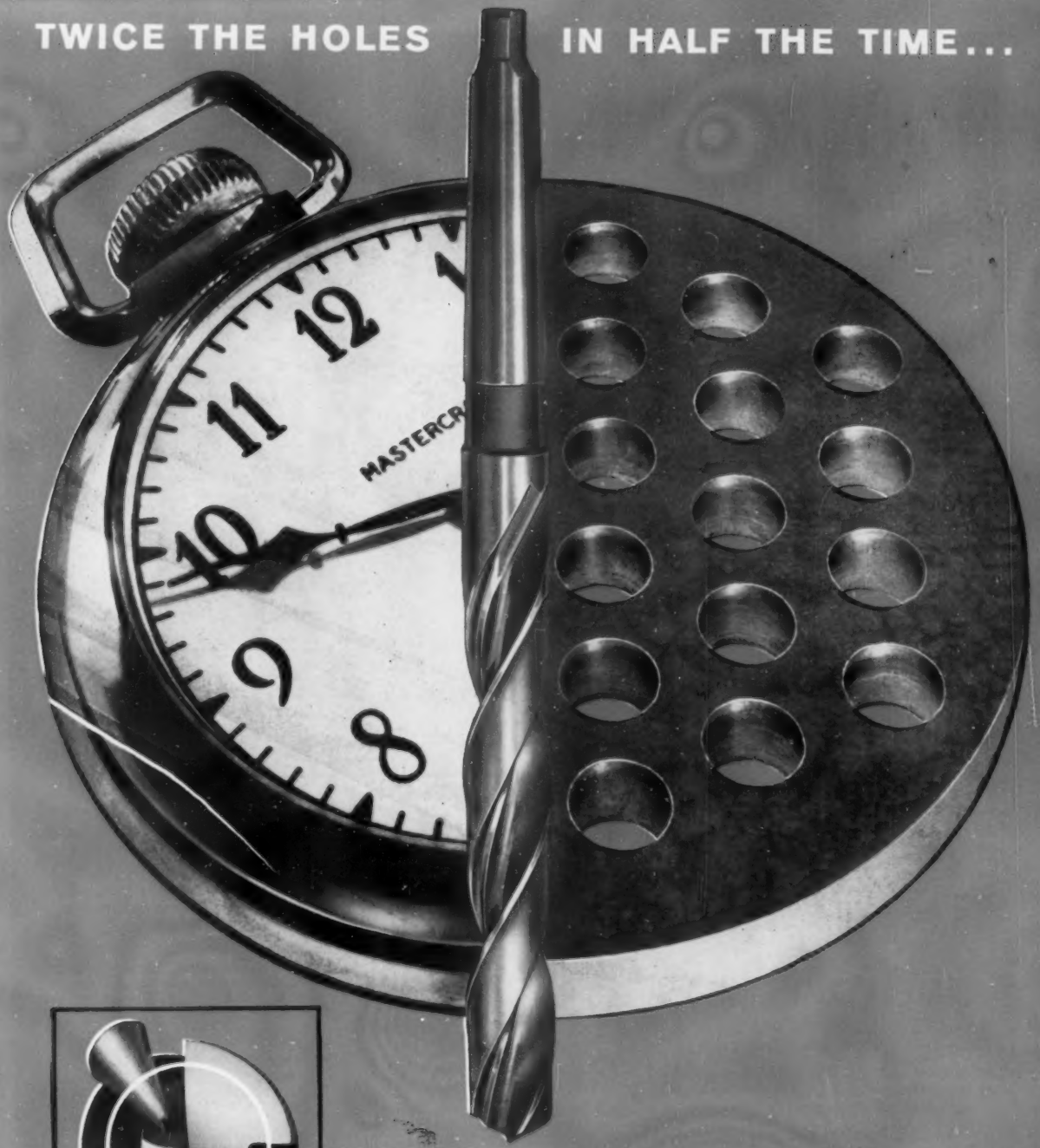
See the New Lapmaster in Operation at Booth 420, ASTE Show, Detroit, April 21-28

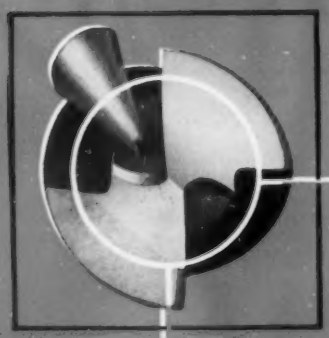
. . . get all the facts on this spectacular new machine . . . and ask for our new catalog covering all other Lapmaster models.

Lapmaster®
. . . THE MACHINE THAT PUT PRECISION LAPPING ON A PRODUCTION BASIS

A product of
Crane Packing Company
6469 Oakton Street, Morton Grove, Illinois
In Canada: Crane Packing Company, Ltd., Hamilton, Ont.

TWICE THE HOLES IN HALF THE TIME...





THE PATENTED RIB that cannot be duplicated

with the new SPEEDICUT "CHIPBREAKER," the drill with the patented rib that permits 50% to 400% higher feed rates, cuts production time and costs.

Have the *SPEEDICUT "CHIPBREAKER"* demonstrated in your own plant on your own equipment and type of work. Write for literature and name of your local authorized distributor.

SPECIFY
SPEEDICUT "CHIPBREAKER"
SPEED WITH SAFETY

SPEEDICUT DIVISION, CHICAGO HEIGHTS STEEL CO. • CHICAGO HEIGHTS, ILL.

There are

MANY REASONS WHY...

the "Big K"

HORIZONTAL METAL CUTTING BAND SAW

...is for you!

Yes it's hard to believe, yet true! This completely new Model 14A "Big K" incorporates many cost saving features which result in cutting capacity and ability far in excess of any other cut-off method of this kind. It provides convenience and versatility not found in other metal cutting band saws.

Facilities for test runs of your material on the "Big K" are at your disposal. Let us know about your production cut-off problems. We'll show you how better quality production can be planned more efficiently at far less tool cost. No obligation, of course.

1. ***POSITIVE CUTTING PRESSURE***
First cut-off machine to use force feed of frame to maintain correct cutting pressures.

2. ***CLOCKWISE BLADE DIRECTION***
A complete hydraulic blade drive permits driving blade to enter cut with least shock for longer life.

3. ***FULLY POWERED FOR PEAK EFFICIENCY***
The blade is driven by a 7½ HP motor through fluid drive. The machine is controlled by 1½ HP motor.

4. ***LARGE CAPACITY***
Full 14" x 24" rectangular capacity.

5. ***BLADE SELECTIVITY***
A unique method of grooving wheels permits use of 1", 1¼" or 1½" wide blades.

6. ***BLADE SPEED***
Infinitely variable hydraulically driven 40 to 450 FPM.

7. ***PIVOT BAR***
The frame of machine rides on pivot bar housed in Timken bearings.

8. ***HYDRAULIC TANK CAPACITY***
A 75 gallon tank is provided to insure low temperature operation for trouble-free service.

9. ***BLADE CLEANING BRUSHES***
Double opposed rotary power driven blade brushes provide clean tooth gullet for efficient cutting.

10. ***CONVENIENT MACHINE HEIGHT***
The bed, take-off table and bar feed are 36" from the floor to reduce operator fatigue.

11. ***PUSH BUTTON CONTROLS***
All controls are centered at a control console away from operation at frame or blade for safe, convenient operation.

12. ***CLEAN, RUGGED DESIGN***
Rugged heavy duty construction along with clean lines of design permit easy servicing and trouble-free operation.

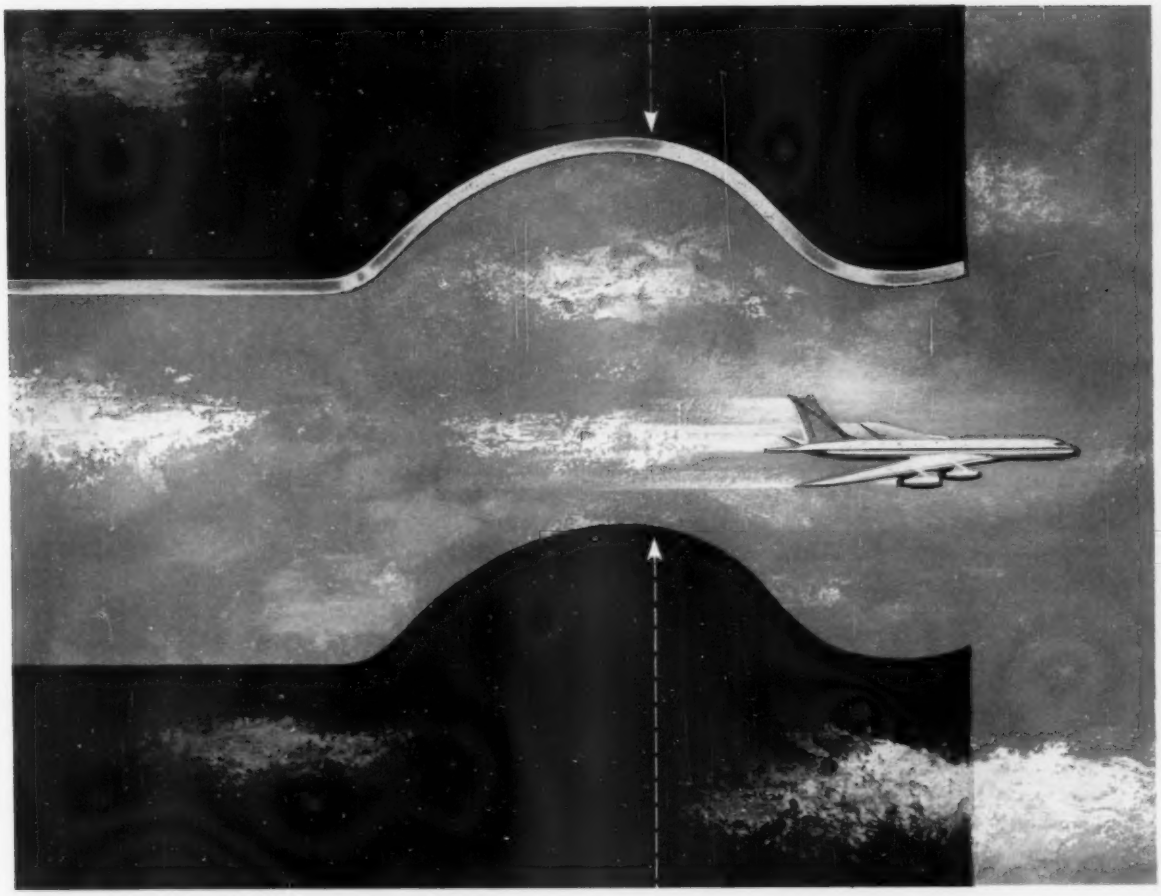
13. ***LARGE CAPACITY COOLANT TANK***
A 15 gallon coolant tank and convenient chip disposal drawer minimize the clean out times and provide ample coolant delivery.

14. ***PRECISIONED MACHINED GUIDE ARMS —***
And Guide Arm Bar . . . provide rigged blade guides to insure accurate cut-off.

15. ***BLADE MOUNTING***
Kalamazoo continues to provide minimum effort for blade changes by mounting blade from top.

MACHINE TOOL DIVISION
Kalamazoo Tank & Silo Company

540 Harrison St.
Kalamazoo
Michigan



Want to save with plastic tools and dies?

Your EPON® RESIN tooling formulator can help you

Tools and dies made of tough but easy-to-handle Epon resin can save you up to two thirds in time, one third in cost! Your tooling resin formulator will show you how Epon resin formulations are saving time and money—*right now*—in applications such as:

High-temperature tooling: Metal-forming stretch dies that can operate at temperatures over 400° F.

Heated tools: Matched dies, with integral heating units, may be made with Epon resin formulations for rapid heat-curing of laminated plastic parts.

Long-lasting metal-forming tools: Castings made of formulated Epon resin, mounted in a crank press, showed no permanent deformation after 28,000 compression-shock cycles.

For tool and die applications, Epon resin formulations offer you the following important advantages:

Excellent tolerance control: Little machining and handwork are required to finish Epon resin tools because of the material's excellent dimensional stability and lack of shrinkage.

Outstanding strength: Jigs and fixtures with thin cross sections can be built from Epon resin-based formulations reinforced with glass cloth. The resulting laminate has high flexural strength and excellent dimensional stability.

Easy modification: Tools and fixtures made from Epon resins may be quickly and easily modified to incorporate design changes.

CONTACT YOUR TOOLING RESIN FORMULATOR

The combination of resin formulator's skill and application knowledge, backed by Shell Chemical's research and resin experience, has solved many important tooling problems for industry. For a list of experienced tooling resin formulators and additional technical information, write to:

SHELL CHEMICAL COMPANY
PLASTICS AND RESINS DIVISION
110 WEST 51ST STREET, NEW YORK 20, NEW YORK

Central District
6054 West Touhy Avenue
Chicago 48, Illinois

East Central District
1578 Union Commerce Bldg.
Cleveland 14, Ohio

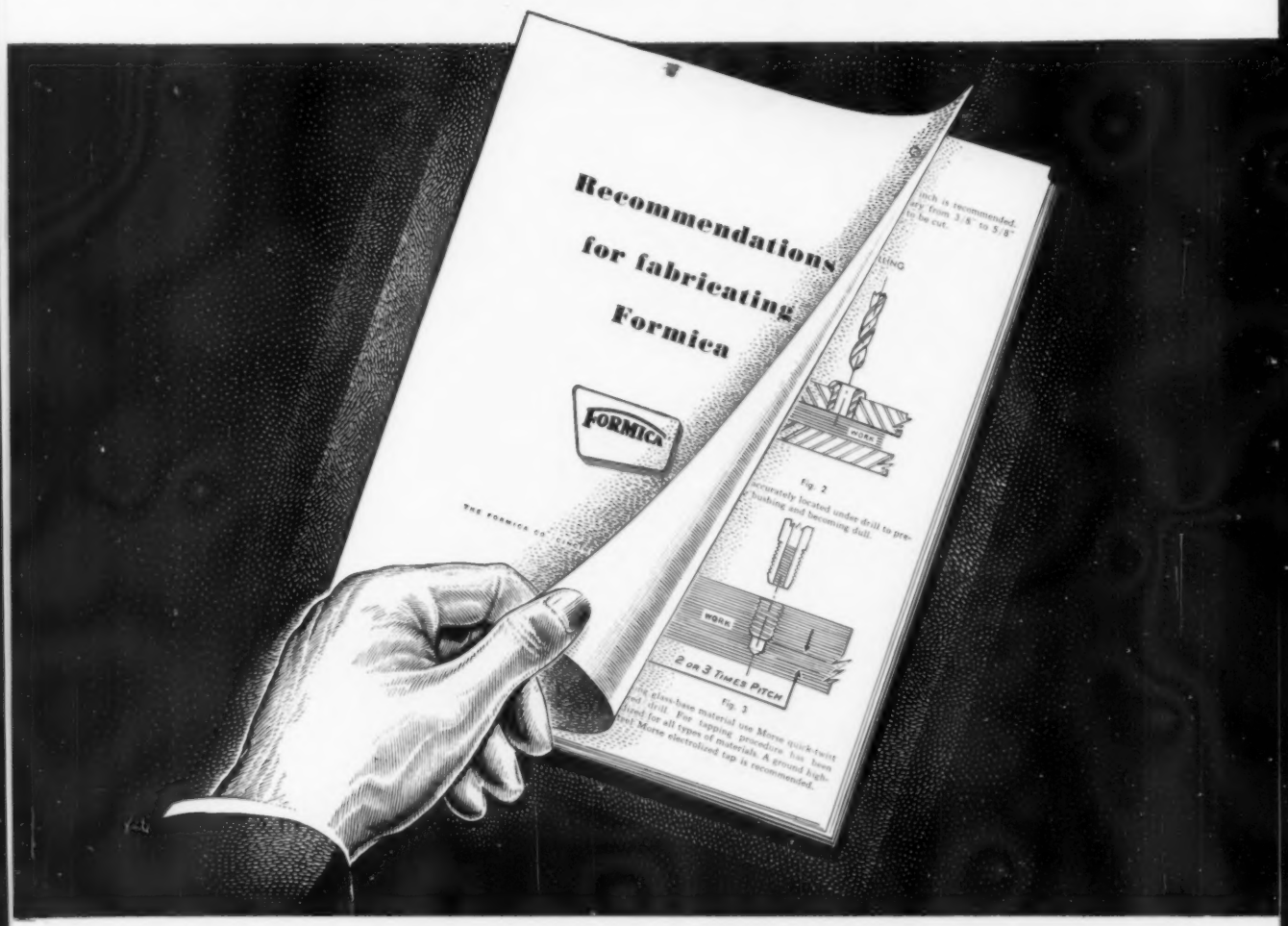
Eastern District
42-76 Main Street
Flushing 55, New York

Western District
10642 Downey Avenue
Downey, California

IN CANADA: Chemical Division, Shell Oil Company of Canada, Limited, Toronto

SHELL

FORMICA SPECIFIES MORSE TOOLS



Morse Electrolized Tools proved best by test for tapping—drilling glass, fabric and paper—base materials.

Formica pulls no punches in its installation manual . . . they recommend Morse. Why? Because they proved Morse Electrolized Taps and Drills *best* by test for installing their material.

Prove to yourself what Formica and other manufacturers have found . . . the exclusive Morse *Electrolizing* Process gives up to 30% longer tool life on the toughest jobs – no matter what base materials are used, there is a Morse Tool designed to help you cut production costs . . . build a better product.

See your Morse-Franchised Distributor. He is the *only* man to see when you want the best in cutting tools. Call him *today*.

MORSE

means "THE MOST" *in Cutting Tools*

MORSE TWIST DRILL & MACHINE CO., NEW BEDFORD, MASSACHUSETTS

Warehouses in: NEW YORK • CHICAGO • DETROIT • DALLAS • SAN FRANCISCO

Morse means more production . . . smoother, more accurate production . . . with every type of cutting tool from drills, reamers, taps and dies, to end mills, milling cutters, slitting saws and "specials". So, if you want the best from every cutting tool you buy, mark your order "MORSE". For if you want *Morse Quality*, there's only one way to get it . . . *specify Morse.*

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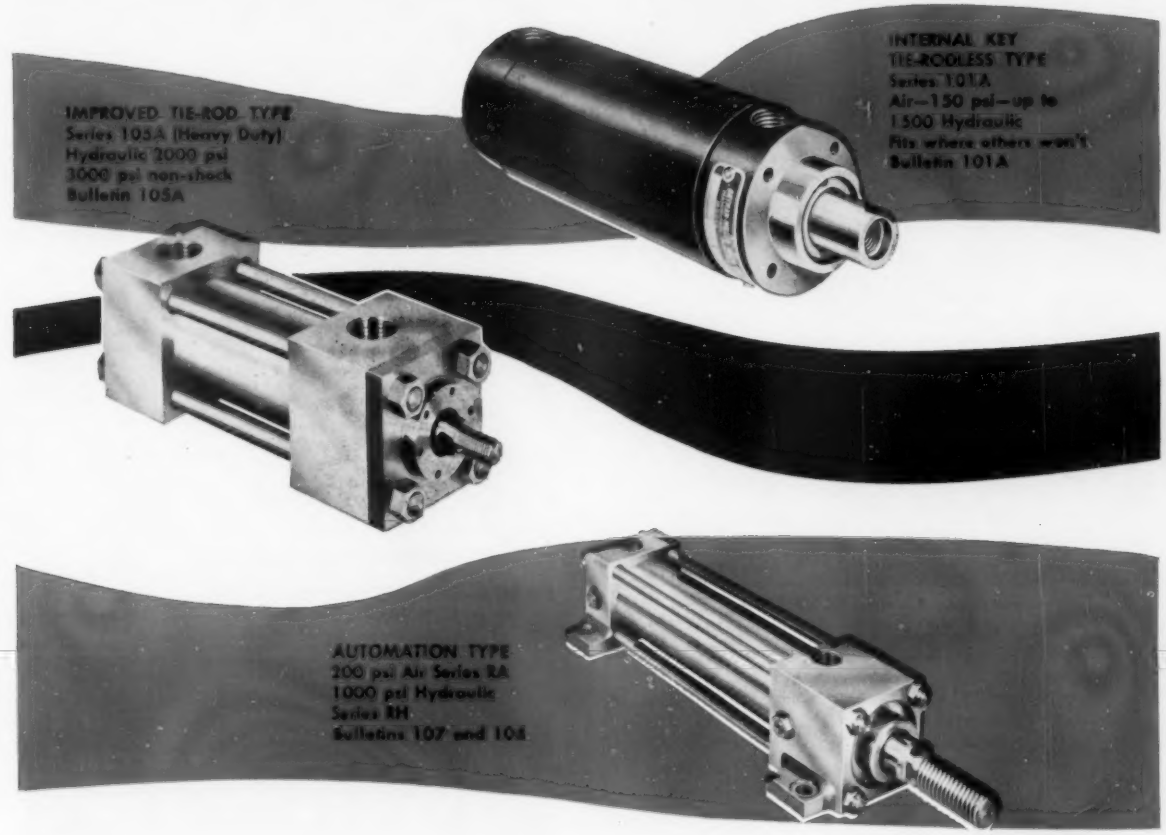
O-M Cylinders Hold Every Stroke to a Close Tolerance



all O-M Cylinders meet JIC standards

Regardless of the bore size, diameter of rod, length of rod travel, type of mounting and position in which they are mounted, O-M Cylinders operate with high reliability and precision with every stroke.

Made of all-steel with bearing bronze; these force generating components take shock loads in stride, cushion piston shock and stand up under continuous cycling. In addition, they are sealed right, have the lowest coefficient of friction, make full power starts and require little maintenance.

Available in a complete range of sizes (1½" to 8" bores) with standard or heavy-duty rods. Complete line of mounts and interchangeable parts. Immediate delivery on most sizes. Mail Coupon *NOW* for descriptive Bulletins.

ORTMAN-MILLER MACHINE COMPANY
13 143rd Street, Hammond, Indiana

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Sentry Hardened Tools

Stay Sharper Longer

There's no better "insurance" against costly, premature dulling of your high speed production tools than reliable Sentry hardening. Sentry's unique Diamond Block provides a truly neutral atmosphere that permits heat treating for maximum hardness without danger of scale or decarburization . . . keeps your production tools sharper longer.

Like a free demonstration? Send us your sample high speed steel tool and we'll Sentry harden it for you free of charge.

9-0

Sentry ELECTRIC FURNACES

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The PULLMAX Cannot be Duplicated or Imitated...

8 SIZES
CAP. UP TO 13/32"

. . . because of its:

- * Unique Patented Features!
- * Strength and Durability!
- * Performance
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- * Quick Tool Change
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- * Capacity

Pullmax machines are sold by a nationwide sales organization, represented in every part of the country by specially trained engineers who analyze, recommend and make demonstrations. Complete engineering facilities are available to solve your special cutting and tooling problems.

Pullmax machines are also backed by a national service organization. Immediate service on all parts is no further away than your phone.

Seeing is Believing: Ask for a Pullmax demonstration unit to visit your plant or send for 16mm sound movie.

Pullmax machines do: straight, circle, inside square, irregular, slot and louver cutting; beading, jeggling, edge bending, flanging, dishing and nibbling.

Write for literature today!

AMERICAN PULLMAX CO., INC. 2451 N. Sheffield Ave., Chicago 14, Illinois

See us, Booth 805, Welding Show, April 26-28, Los Angeles.

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NOW over 1500 sizes of Circular Form Tools and Blanks are listed in Somma's new catalog

Write for your copy of the most complete catalog in the industry—includes Tools and Blanks for all size Brown & Sharpes and Davenports as well as Blanks for New Britain-Gridley, Cleveland, Warner & Swasey, National-Acme and Conomatic machines.

Let Somma Standard Circular Form Tools give you uniform correct dimensions, better finish and appearance, less setup trouble. In short—Maximum production at the lowest cost.

SOMMA TOOL CO., INC.
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West Coast Warehouse: 576 N. Prairie, Hawthorne, Cal.

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CIRCUIT-MASTER missing parts detector

detects: non-ejection • mis-feed • buckling • end-of-material

Priced as low as $276.75 complete!

Protect all your dies from damaging overloads for less than the replacement cost of one. Circuit-Master's patented electronic circuits automatically stop your machines BEFORE an unejected part can cause a die-damaging overload.

Simple to install, no changes to equipment or wiring required—Circuit-Master is completely automatic, no adjustment of any kind.

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Originators and manufacturers of Circuit-Master Overload Detector, Autotransfer, Automat, Automold and Missing Parts Detector.

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DRILLING? FOR PIPE TAPS?

It's so EASY to do it right · · · · · ·

with MOHAWK STANDARD SUBLAND DRILLS

Fast and economical, too! With a Mohawk Standard Drill-Chamfer subland, you drill and chamfer simultaneously . . . all in one operation.

Think of it! You do the job *right* and save the extra tools, the jig and fixture movement, working time and eliminate tap breakage as well as scrapped parts. All this . . . plus the bonus fact that *one* Mohawk "standard" will outwork and outlast dozens of ordinary drills because Sublands have cutting flutes for each diameter, they can be resharpened (in your plant) without losing concentricity.

There's no excuse... Mohawk "standards" are available in all sizes, types or combinations in both factory and local stocks. You can start to save the Mohawk way—today!

MOHAWK STANDARD SUBLANDS are stocked in these three basic types in three step lengths and three shank styles. *All practical sizes and combinations.*

Subland Drill-Chamfer | Subland Drill-Counterbore | Subland Drill-Drill

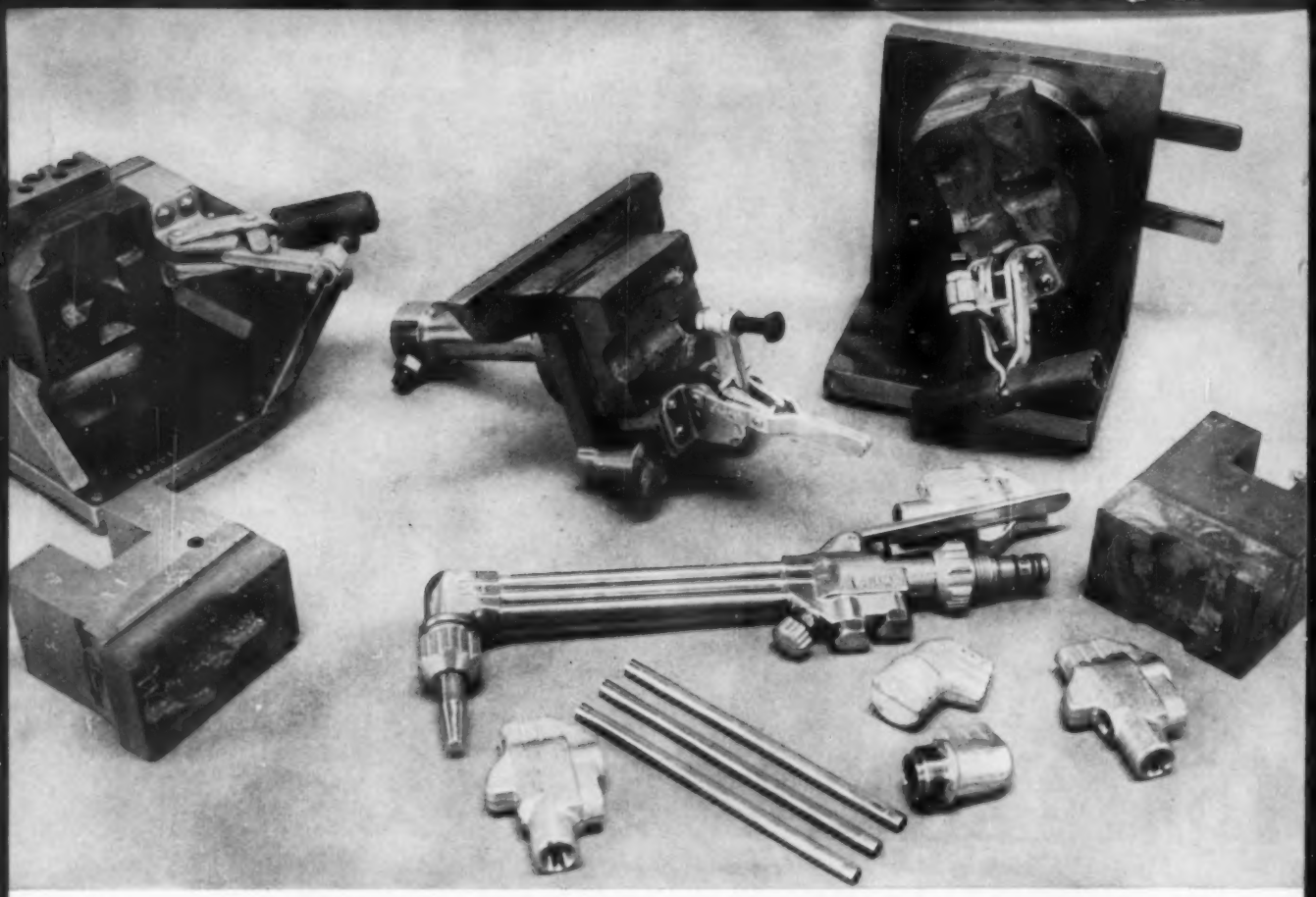
Let Mohawk prove to you that a Standard Subland is the most efficient and economical tool to use for multiple drilling operations. Check your maintenance costs along with the number of pieces per grind. Mohawk will guarantee you a provable, substantial saving.

Ready... and Waiting

...your new catalog of Mohawk "Standards" is awaiting your request.

world's largest producer of Subland Drills

Mohawk
TOOLS, Inc.
Montpelier, Ohio



Cutting torch and component parts made by Smith Welding Equipment Corp., Minneapolis, Minn., are shown with some of the plastic tools used in their manufacture.

New tools made overnight

with epoxy resins

Pouring tooling compound into mold to form chuck jaws. Lining up and pouring takes about half an hour. Compound hardens overnight. These epoxy compounds are produced by **Rezolin, Inc.,** Los Angeles 45, Calif.

Short production runs, frequent design improvements, and tight production schedules can benefit from tooling with compounds based on BAKELITE Epoxy Resins. Examples range from jigs, fixtures and chucking jaws for making the small precision parts shown here, to giant checking fixtures and Keller models used in automobile and aircraft manufacture.

These tooling compounds based on BAKELITE Brand Epoxy Resins are relatively easy to handle, and they harden at room temperature. The liquid resin is mixed with its liquid hardener and poured into place. Since curing shrinkage is negligible, the resulting tools are extremely accurate. They can be machined for further precision.

These properties mean that tools of any size can be produced with speed and economy. The resin can cure overnight. You can have low-cost tools for many operations for which conventional tooling would be expensive.

Write to Dept. DH-20E, for free copy of our booklet, "Why Plastic Tooling." Union Carbide Plastics Company, Division of Union Carbide Corporation, 270 Park Ave., New York 17, N.Y. *In Canada:* Union Carbide Canada Limited, Toronto 7, Ontario.

UNION CARBIDE

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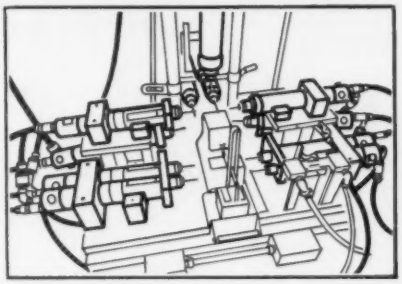
ARO IS YOUR ANSWER— LOW COST *Automation!*

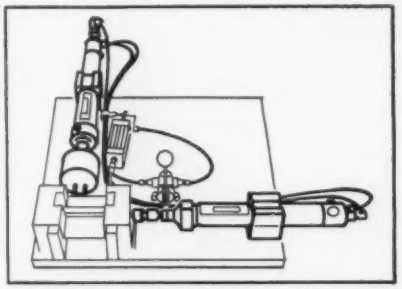
DRILL 3,000 per hour

Set up any number of Aro Self-Feed Drills in single fixture, then drill up to 3,000 holes per hour automatically. Capacities from $\frac{1}{16}$" to $\frac{1}{2}$" . . . speeds from 500 to 20,000 rpm . . . stroke lengths from $\frac{3}{8}$" to 6". Use any combination of types and speeds, mount drills in any position.



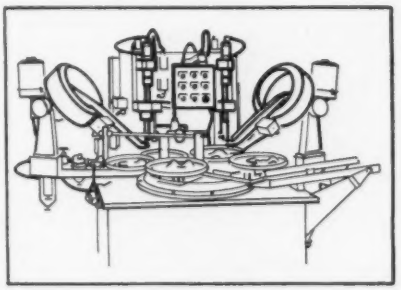
TAP 2,400 per hour

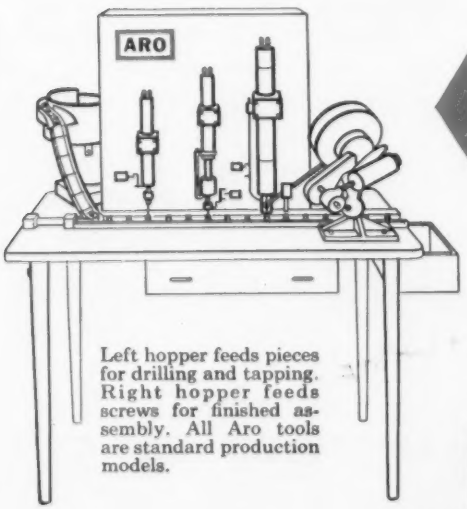
Combine your drilling and tapping operations in one fixture and eliminate costly handling. Aro Self-Feed Tappers have capacities up to ¼"-20 in mild steel, or larger holes in softer materials. Speeds of 500, 900, 1,450 and 2,700 rpm. Stroke lengths up to 1½". Accessories for precision depth.



FASTEN 3,000 per hour

Go automatic on your threaded-fastener operations with Aro Self-Feed Screwdrivers-Nutsetters. Standard range of speeds for the most commonly specified screw sizes. Uniform torque settings held within close limits. All models available with precision ball-type clutch.





Left hopper feeds pieces for drilling and tapping. Right hopper feeds screws for finished assembly. All Aro tools are standard production models.

see ARO self-feed air tools *IN ACTION*— drill, tap, fasten!

BOOTH No. 1918
A.S.T.E. SHOW

FINISHED SAMPLE IS YOURS!

This top is machined and assembled automatically on fixture at left. It's yours to keep . . . and it's a reminder that *if it's ARO it's tops!*

ARO®

THE ARO EQUIPMENT CORPORATION, Bryan, Ohio
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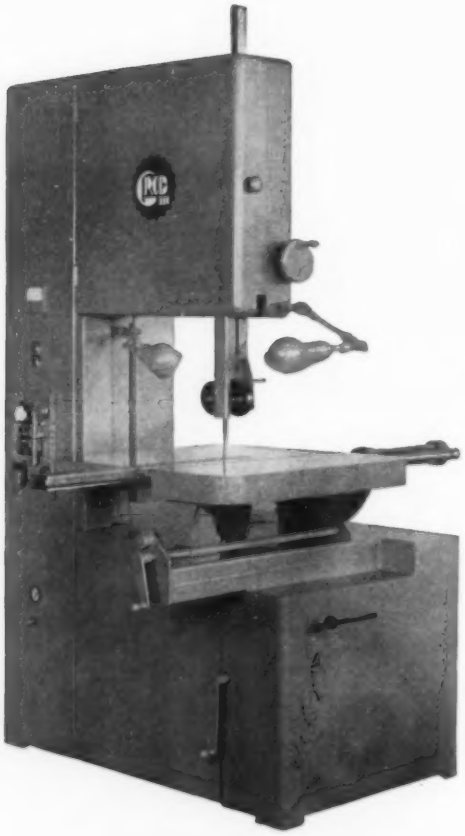
GROB SPELLS THE DIFFERENCE IN BAND SAW MACHINES

The new GROB 24" universal band saw
has all the famous GROB features:

Quality • Efficiency • Durability • Strength
Utility • Low Maintenance • Reasonable Cost



- Speeds infinite from 35-12000 FPM covers both cold and hot sawing
- Variable drive 3-speed transmission with precision rolled gears and splines transmits 15 HP
- Hydraulic table feed

See the difference demonstrated in our dealers' showrooms

or

Write GROB INC. for complete specifications

GROB also manufactures a complete line of:

BOOTH 438
ASTE SHOW

'60

BUTT WELDERS
FILING MACHINES
GEAR ROLLING MACHINES

GRAFTON, WISCONSIN

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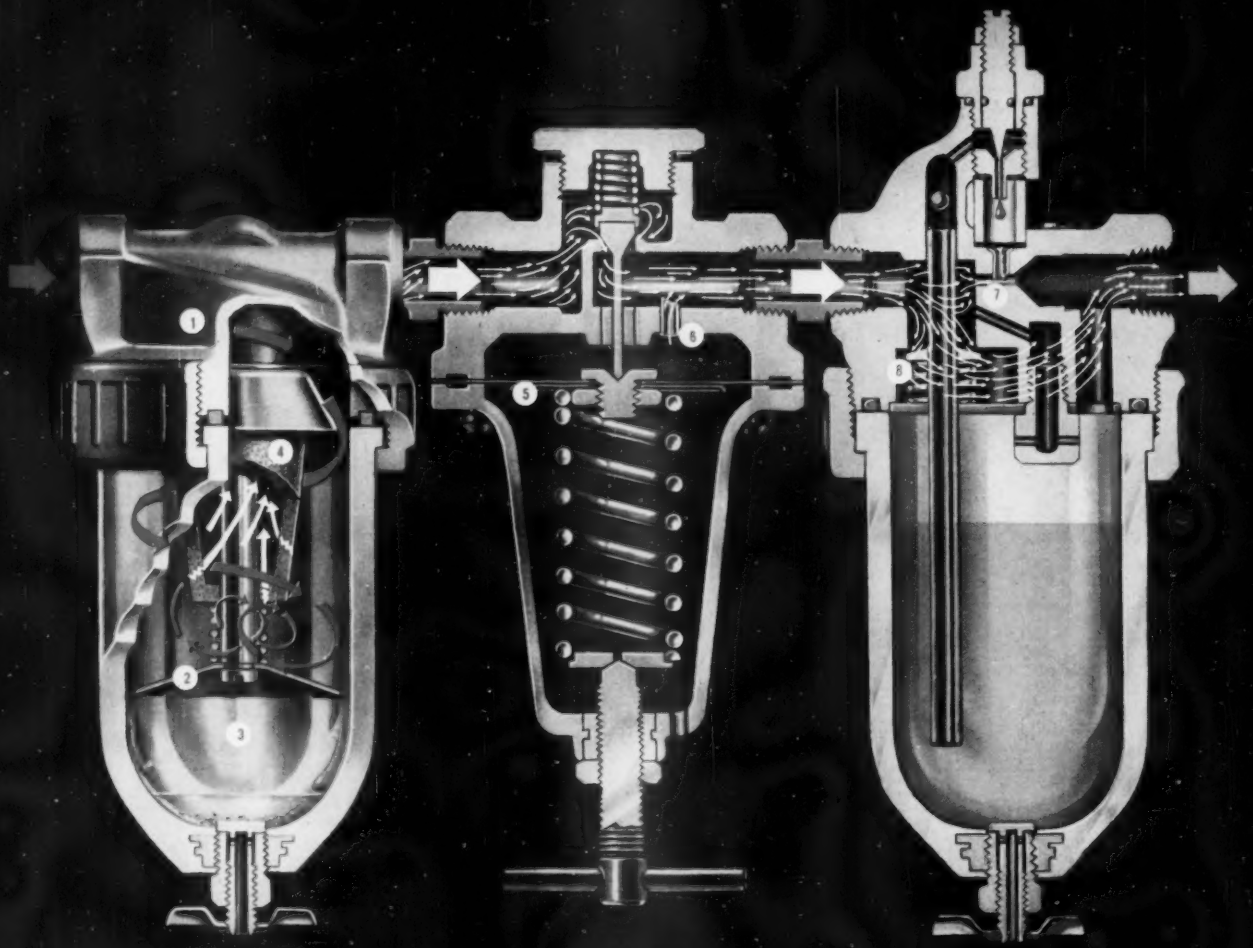

Curved inlet ❶ directs incoming air in downward helical pattern. Larger impurities and condensate are "thrown out" by centrifugal action, collecting on bowl sides and spiraling downward past baffle ❷ into quiet chamber for draining off. Baffle traps sediment in quiet chamber ❸ and allows only dry air centrifugally cleaned of larger impurities to reach porous bronze filter element ❹ where finer particles are filtered out.

Diaphragm of large area ❺ is of BUNA-N—imparts extra sensitivity for response to even minute reduced pressure variations. Aspirator ❻ acts directly on diaphragm, providing instant compensation for fluctuating loads . . . assures precise control and stabilizes pressures reaching individual pieces of equipment.

High velocity venturi section ❼ provides ultra-fine, enduring atomization at air flow rates even less than 1 CFM. An exclusive by-pass feature ❽ provides lubrication at high flow rate without excessive pressure drop—wide range performance in **one unit.** Proof of lubricating efficiency assured because **all** visible metered oil is atomized.

NOW! Get this efficient TRIPLE LIFE-GUARD protection for your pneumatic equipment

A continuous supply of clean dry air . . . at a constant pressure . . . with just the right amount of lubrication provided at points of friction and wear. Air-operated equipment requires this three-way protection today; the Watts combination of pneumatic controls *assures* it.

You can expect *high efficiency* from the Watts line of advanced-design air line filters, regulators, and "Perma-Fog" lubricators. It's the *quality* assembly. Specialists in protection and control devices since 1875, Watts is setting new *standards* of efficiency in pneumatic operation.

WATTS

FILTERS
REGULATORS
LUBRICATORS

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ASTE TOOL SHOW

Watts Regulator Company — Industrial Division — **6 Embankment Road** — **Lawrence, Massachusetts**

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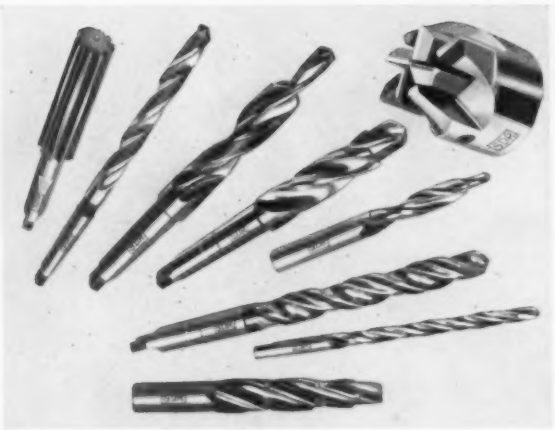

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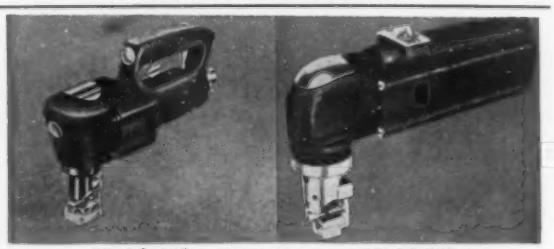

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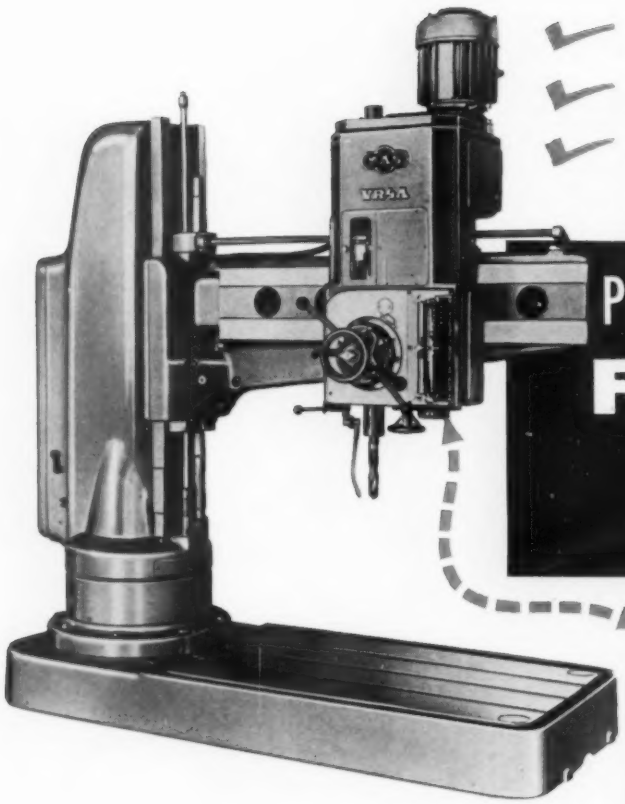

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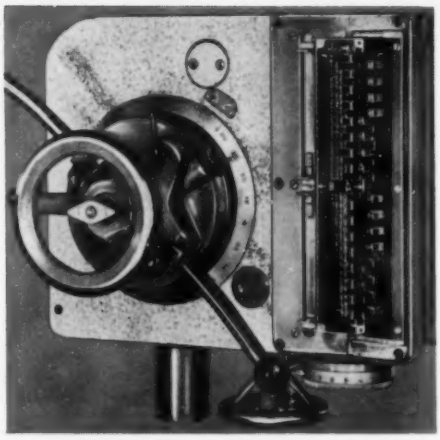

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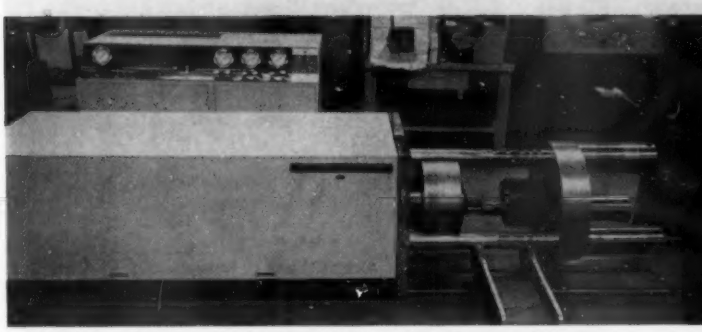

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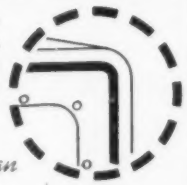

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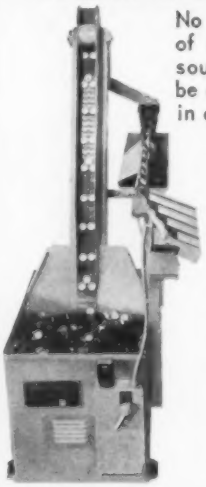

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Sixty years of experience in the manufacture of high precision machine tools is reflected in the dependable accuracy and quality of the **1520 Jig Borer** . . . a product of Newall Engineering Company Ltd. of England.

The PATENTED Newall Measuring System, featured in the **1520,** is entirely independent of the screws and insures constant setting accuracy throughout the life of the machine. It consists of hardened, ground and lapped rollers, guaranteed accurate to 0.00002". The system precludes wear, allows for no cumulative error and is unaffected by any temperature changes. Microlators, used in conjunction with the roller trains are graduated in 0.0001". Widely spaced divisions permit settings, by interpolation, to 0.00005". The table position, is at all times, observed on a precision dial indicator. This system allows PRE-POSITIONING while work is in progress. Other Newall Jig Borers are available with precision leadscrews or optical measuring systems.

A 3½" diameter quill assures rigid support for the Nitralloy spindle running in ultra-precision taper roller bearings at the lower end and in a double-purpose ball bearing at the top. The spindle nose features a PATENTED Captive Nut . . . . a quarter turn will clamp and rapidly extract the tool.

Rotation of the star wheel automatically clamps and unclamps the feed-box on the column.

A three speed motor drives the spindle through a four speed gear-box, giving 12 speeds from 67 - 3,000 rpm. Three power feeds are provided. An electro-magnetic spindle brake is activated by depressing the stop button and is released when the starter is engaged. Gear changing automatically locks the spindle rotation.

All machines are equipped with J.I.C. electrics and N.E.M.A. frame motors.

A full range of Jig Borer sizes is available, including NUMERICALLY CONTROLLED models.

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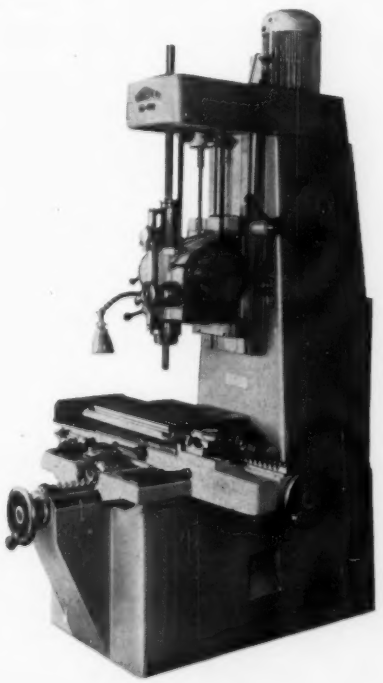
Specifications of the Newall 1520 Jig Borer

Table surface	in.	15 x 20¾
Longitudinal travel	in.	15½
Cross travel	in.	10½
Vertical feed of the quill	in.	5
Vertical adjustment, quill head on col.	in.	12
Distance, spindle-to-table max.	in.	20
min.	in.	3
Spindle speeds	rpm	67 - 3,000
Spindle taper	MT	No. 2 (Std.)
Spindle motor	hp	1½



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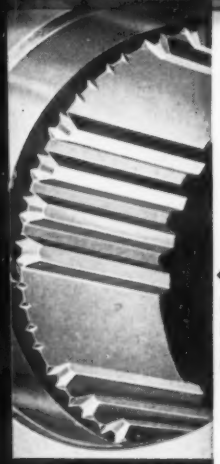
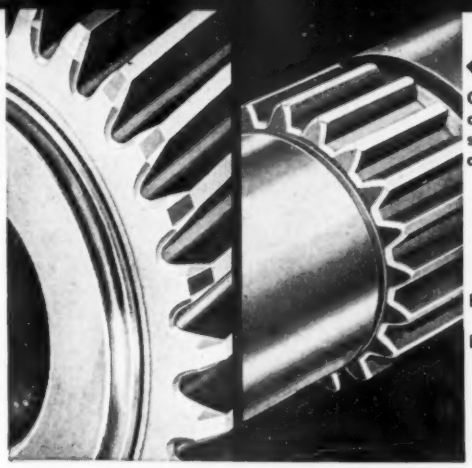


Helical gears like this are deburred at 5 teeth/second on a BME-14 or -19.

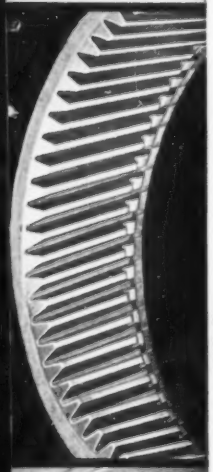
Internal splines pointed on single or multiple station BMI machines.



Outer ends of spline on planetary sun gear shaft deburred on a BME-14 or -19.

Both ends of teeth on a jaw clutch are deburred and chamfered on a BMI-15.

Get rid of BURRS the positive way-



Internal gear burred and chamfered on a BMI-15.

Chamfering leading tooth end of speedometer worm.

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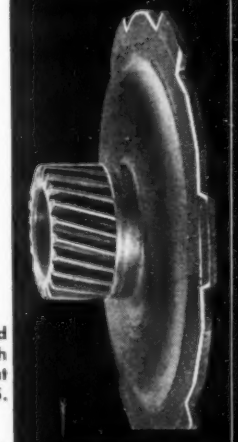

Contour of stamped transmission clutch part deburred two at a time on a BMI-15.

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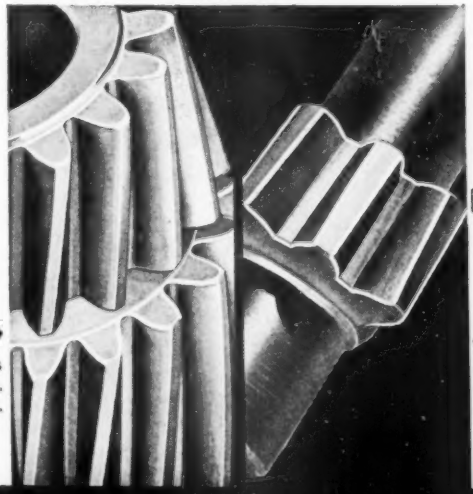
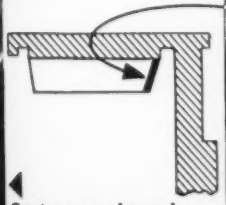
Both ends of teeth of this ring gear burred on one Burrmaster.

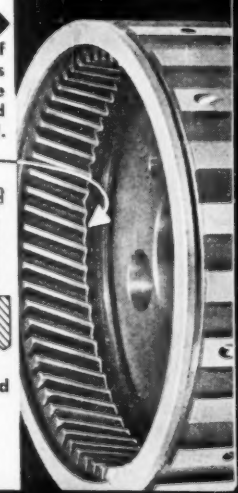


Chamfering teeth ends complete in a 3/16 in. wide groove.

The inside ends of internal teeth on this cup-shaped part are accurately and positively deburred.



Sector gear burred, chamfered and topped on a duplex BMED-24.



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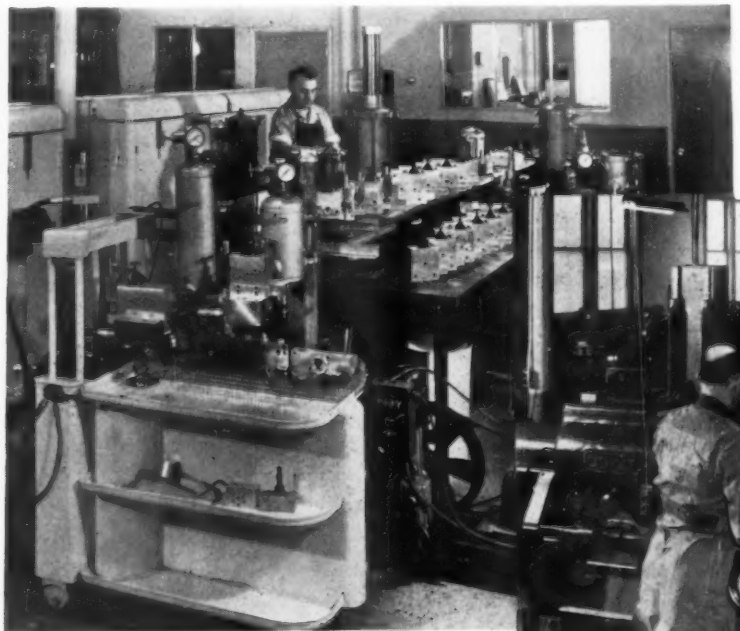

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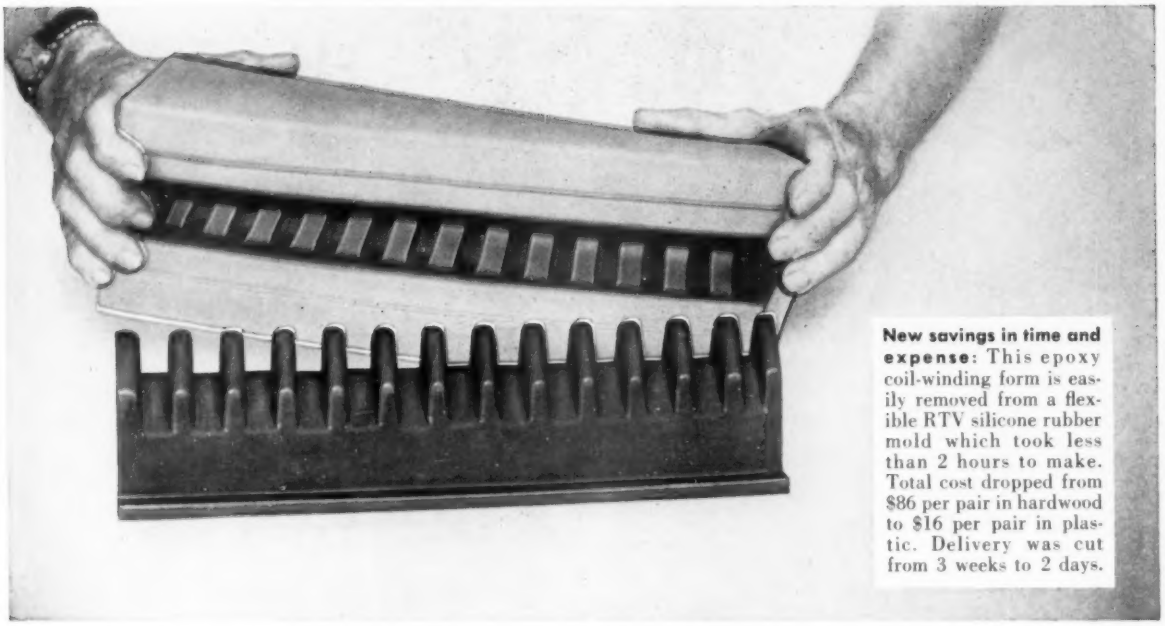
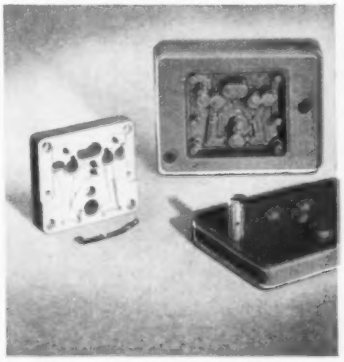


New savings in time and expense: This epoxy coil-winding form is easily removed from a flexible RTV silicone rubber mold which took less than 2 hours to make. Total cost dropped from $86 per pair in hardwood to $16 per pair in plastic. Delivery was cut from 3 weeks to 2 days.

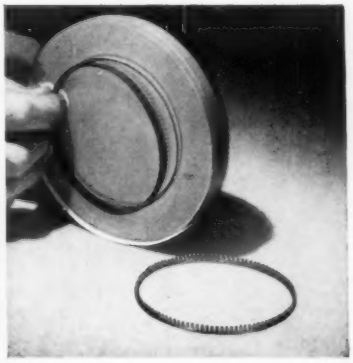
General Electric RTV silicone rubber opens up new fields in tooling and model making

Flexible, needs no parting agent, low shrinkage, duplicates glossy surfaces and fine detail

High-quality prototypes: RTV (room temperature vulcanizing) silicone rubber accurately reproduces surface finish and fine detail. This prototype control knob and other more complicated parts are easily removed from molds without using parting agents. Shrinkage less than 0.2%.



Precision, low-cost tooling: Previously machined from plastic laminate at a cost of $175 each, this fixture is now produced in a two-piece RTV mold at a saving of over $150 per part!



Ideal for casting fragile parts: 20 epoxy duplicates of this fragile actuator ring (.030" thick) were produced in this RTV mold. Even broken machine parts can be reassembled and used as a master to mold new parts.

For application data on RTV silicone rubber write General Electric Company, Silicone Products Dept., Section H41, Waterford, New York.

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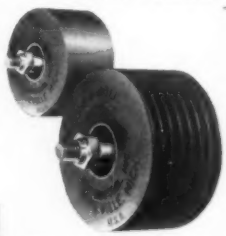

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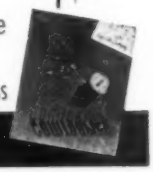

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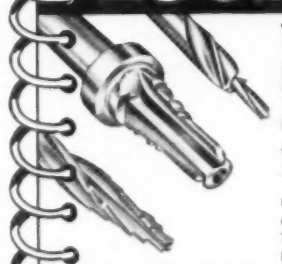

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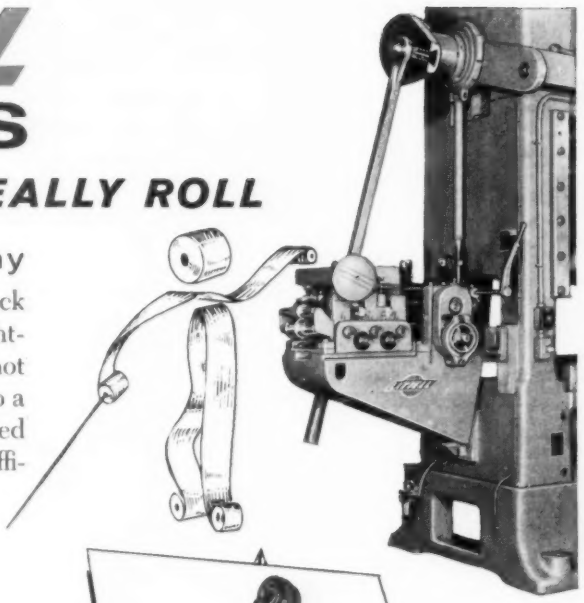
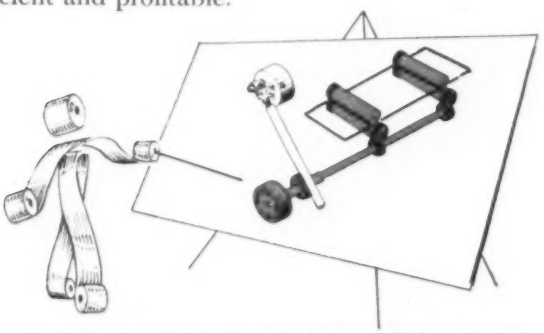
ROLL FEEDS

Make Press Production REALLY ROLL

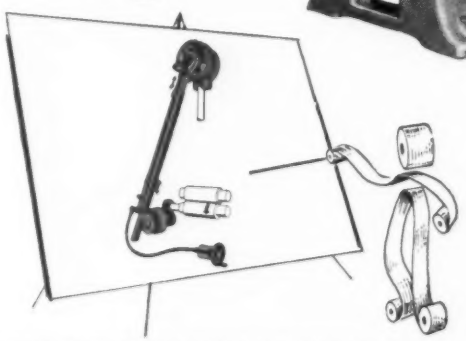
Old Pro "Coily" Points Out Why

"Coily" has been around press rooms since coil stock came into the picture. He has seen Littell Straighteners and Feeds widely copied, in design, (but not in performance) time after time. He points here to a few of the new advanced design Littell Roll Feed features that make punch press operation more efficient and profitable.

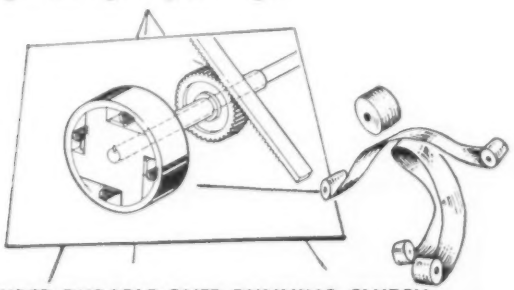




GEARS AND ROLLS ARE PRECISION CONTROLLED
Littell Rolls and Gears respond to control because they are light in weight. With less inertia to overcome, these strong, yet light rolls and gears start easy, go faster, and stop quickly. Big, new type disc brakes further assure the control that means accurate feeding in the higher speed ranges.



LITTELL MICRO RUNNING ADJUSTMENT
enables the punch press operator to adjust feed length plus or minus ⅛" while press and feed are running. A big help in setting up progressive dies requiring extremely accurate feed lengths.



SUPER DURABLE OVER RUNNING CLUTCH
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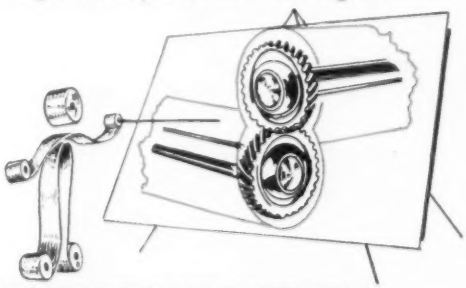

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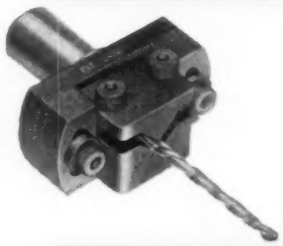

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DA-10	1/64"–1/8"	5/8"
DA-12	1/64"–1/8"	3/4"
GA-12	1/16"–1/4"	3/4"
GA-16	3/16"–3/8"	1"
KA-16	1/8"–1"	1"
KA-24	1/4"–1"	1 1/2"
PA-24	1/4"–1 1/2"	1 1/2"
PA-28	1/4"–1 1/2"	1 3/4"

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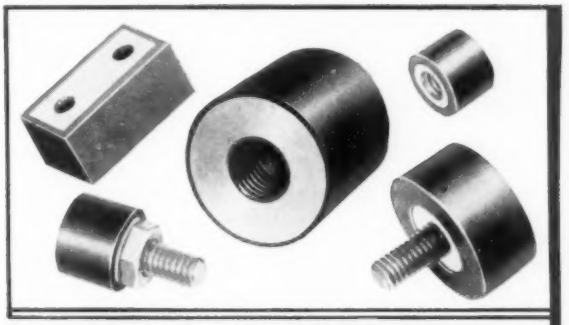

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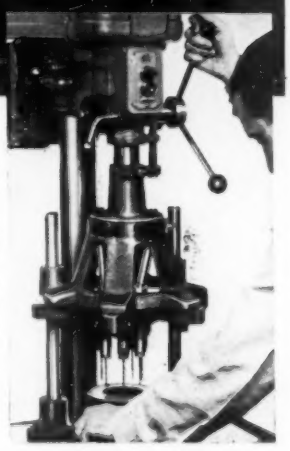

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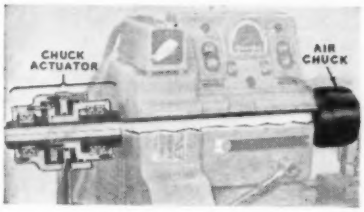

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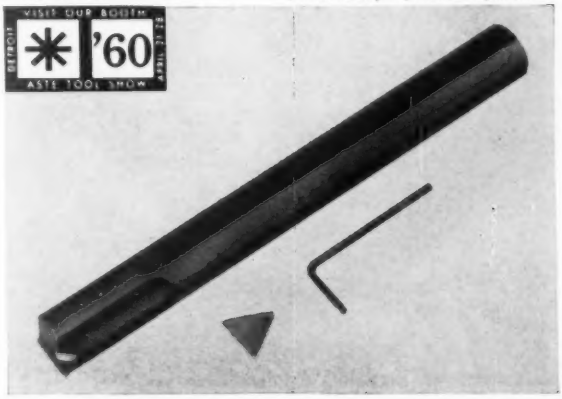

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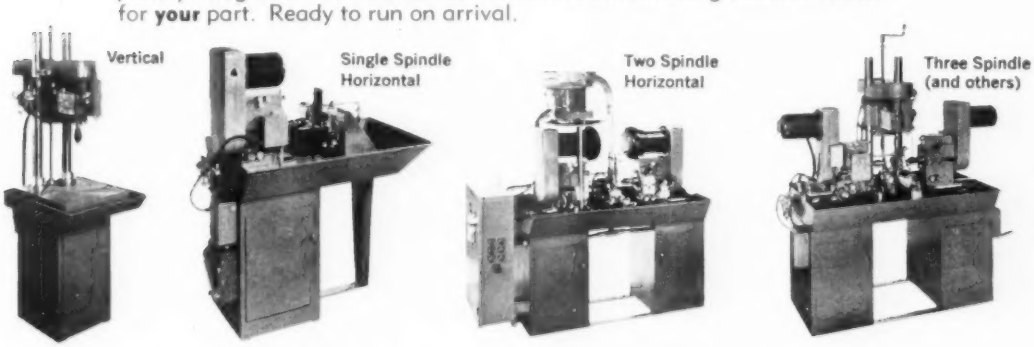

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April 1960

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LOOKING AHEAD

By T. W. Black
Senior Associate Editor

"Spike power"—a new electronic control and power system—promises to revolutionize resistance welding. The "spike" is a pulse of power that lasts about one microsecond. This pulse has extremely high energy. Welding penetration and fusion are almost instantaneous, take less time and less power, and generate far less heat.

Transformers are about one-tenth the size of those used for conventional resistance welding. Robotron Corp., Detroit, Mich., developed this control principle, which is being field tested.

Laminated plastics are now being studied for missile applications. Engineers at Taylor Fibre Co. have started a program to develop better materials for nose cones, throat nozzles and other parts.

Nylon-web, phenolic resin laminates and glass-epoxy laminates are currently proving useful in missile applications. The grades now in use were developed primarily for electrical applications, where a premium is placed on such properties as electrical resistivity and resistance to water absorption. It is felt that research will provide new materials with high resistance to temperature erosion and high thermal insulation.

A systems engineering approach to automation has been suggested by George M. Muschamp, Minneapolis-Honeywell vice president. Mere aggregations of automation equipment may or may not pay. Automated equipment should be integrated into economically and technically sound systems for best results. Over-all planning is required.

Automation and the development of new and improved machines and tools can make existing manufacturing equipment obsolete in a hurry. The need for modernization of manufacturing facilities is hampered by present federal tax policies on depreciation allowances for worn-out and obsolete equipment, according to W. C. Newberg, Chrysler Corp. executive vice president.

Speaking of those who draw up and enforce tax legislation, Mr. Newberg says: ". . . they still tend to think primarily about the time it takes to tire out a piece of iron, and not about the ever-shorter length of time it takes a competitor—domestic or foreign—to make today's equipment hopelessly inadequate."

Tax incentives to accelerate basic research are being urged by Mark W. Cresap, Jr., Westinghouse president. Pointing out that more than 50 percent of the basic research in this country is now being supported by the Federal government, Mr. Cresap stresses that additional support should come from industry, aided by faster write-offs for new research facilities, tax credits for research contributions or expenditures and income tax write-offs.

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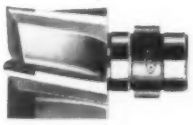

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2. STURDY DRIVE . . . diametrically opposed drive lugs engage corresponding abutments in the holder.

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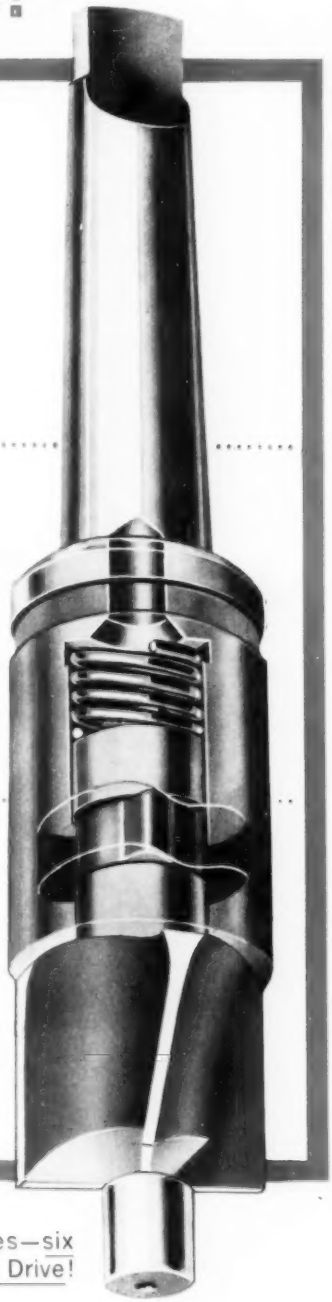

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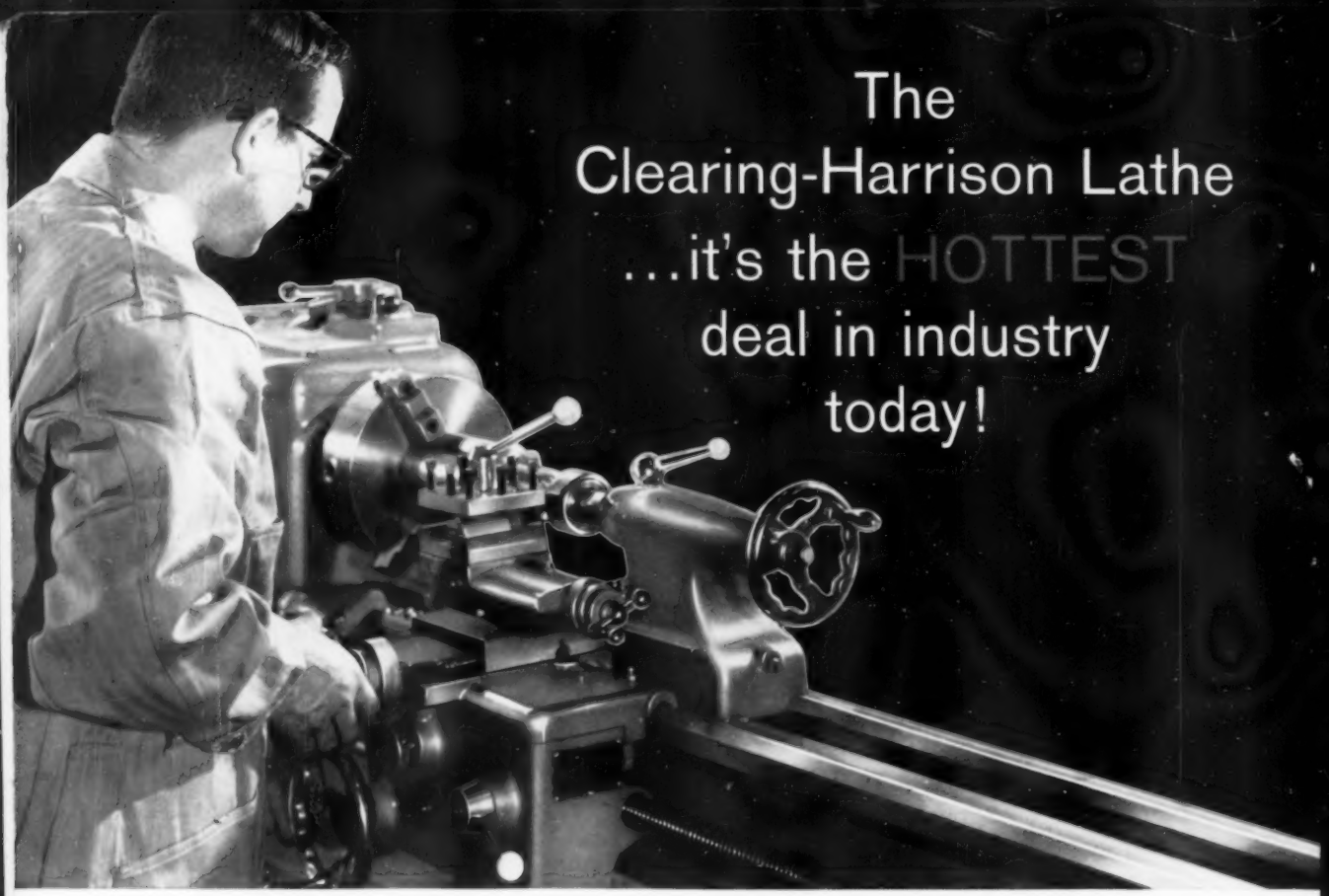

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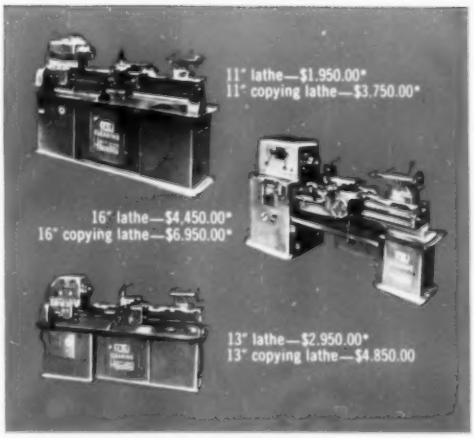

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